Vol. 91. *No.* 5 New York, February 4, 1928 *Pages* 235-286

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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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Statistical Co-operation of Utilities Appreciated

TO RETURN statistical information on the day after the request is received is quick work and indicative of a fine spirit of co-operation on the part of the sender. This was recently done by two companies, the Worcester (Mass.) Electric Light Company and the Potomac Electric Power Company, in connection with data for Electrical World. Shortly afterward the Middle West reports began coming in, represented by the Detroit Edison Company and the Public Service Company of Northern Illinois.

While this comment may appear unduly to emphasize a single incident, the occurrence is quite typical of the ready response of electric power companies to Electrical World requests for information. This widespread co-operation is particularly appreciated because we are fully aware that some of the answers entail much work. The industry collectively spends thousands of dollars annually in giving to the public, freely, statistical information about itself. Despite its occasional misuse and, we sometimes suspect willful, misinterpretation, the harm is infinitesimal compared with the benefits of this mutual interchange and frankness. The Electrical World gladly expresses its appreciation.

McGRAW-HILL PUBLISHING COMPANY, INC.
Tenth Ave. at 36th St., NEW YORK, N. Y.

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James H. McGraw, Jr., V.-Pres. and Treas.
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New York Dist. Office, 285 Madison Ave.
Washington, National Press Bldg.
Chicago, 7 South Dearborn St.
Philadelphia, 1600 Arch St.
Cleveland, Guardian Building
St. Louis, Bell Telephone Building
San Francisco, 883 Mission Street
London, 6 Bouverie Street, London, E. C. 4

Cable Address "Machinist, N. Y."
The annual subscription rate is $5 in the United States, Canada, Mexico, Alaska, Hawaii, Philippines, Porto Rico, Canal Zone, Honduras, Cuba, Nicaragua, Peru, Colombia, Bolivia, Dominican Republic, Panama, El Salvador, Argentina, Brazil, Spain, Uruguay, Costa Rica, Ecuador, Guatemala, Haiti and Paraguay. Extra foreign postage, $4 (total $9 or 38 shillings). Subscriptions may be sent to the New York office or to the London office. Single copies, postage prepaid to any part of the world, 25 cents.
Change of Address — When change of address is ordered the new and the old address must be given. Notice must be received at least ten days before the change takes place.

Copyright 1928
By McGraw-Hill Publishing Company, Inc.

Published weekly
Entered as second-class matter Jan. 30, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879.
Printed in U. S. A.

Circulation of this issue, 19,550

Publishers of
Engineering News-Record — American Machinist
Power — Chemical and Metallurgical Engineering
Coal Age — Engineering and Mining Journal
Electrical Merchandising
Ingeniería Internacional — Electric Railway Journal
Bus Transportation — Construction Methods
Electrical World — Radio Retailing
Electrical West
(Published in San Francisco)
American Machinist—European Edition
Published in London

Member Audit Bureau of Circulations
Member Associated Business Papers, Inc.

Advertising Index—Alphabetical, 130; Classified, 124, 126, 128; Directory of Engineers, 64, 65; Searchlight Section, 66-70

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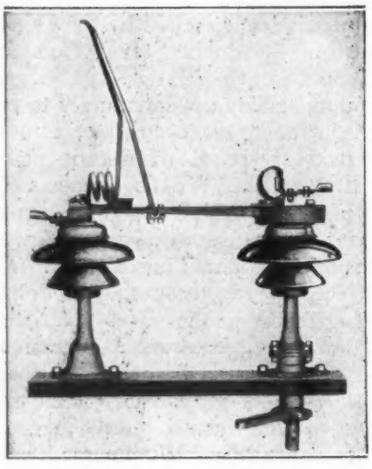

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Electrical World

Published by McGraw-Hill Publishing Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 91 — *New York, Saturday, February 4, 1928* — NUMBER 5

Electrification Power Supply

UTILITIES are confronted with the problem of supplying railroads with electricity. The railroads are confronted with the problem of electrification and purchased electrical energy. There is a mutual interest and responsibility which calls for co-operative work. Whether electrification involves direct current or alternating current is not of great importance to utilities which furnish the energy except as each system reflects itself in equipment to change energy on the 60-cycle systems in use by the utilities. This energy can be changed to direct current by rotary converters, motor-generator sets or mercury-arc rectifiers. It can be supplied as 25-cycle energy by use of frequency converters of several types. But for a given electrification project it is important that the utility and railroad engineers get together so that a broad perspective and analysis will give a decision as to type of electrification and method of energy supply which will best meet all factors. Naturally, the best transportation for the least money is desired.

Just now there is occurring a try-out period in the supply of railroads. In the direct-current field several types of equipment are in use to convert utility energy to railroad energy. In the alternating-current field several frequency-changer types are in use and several methods are proposed for handling a single-phase load on a three-phase system. In addition, for any system there are several methods for limiting demands, for isolating trouble and for handling emergencies. It is important that the data and experiences obtained from these installations be weighed and studied. A big electrification program is under way and mistakes should be avoided.

* * * *

Two Codes or One?

A UNIFORM electrical code for the industry is a desirable goal and conforms to good principles of standardization. Such a program has been started recently and is based on the consolidation of the National Electrical Code and the Electrical Safety Code. But many factors must be weighed before the object can be attained or even be considered desirable for the immediate future. The National Electrical Code has been formulated on an experience basis and has a standing because it is used. It incorporates fundamental construction and installation standards. The Electrical Safety Code is new; it is little used in practice and is primarily devised to fix safety standards. Its provisions are apt to be changed when they come to be applied in the field, although the present edition of the code is very complete and has been prepared carefully. However, it represents the opinion of a committee and not the results of field trials over a period of years.

Under the conditions facing the electrical industry it is good policy to go slow on a program for consolidating the two codes. It might be better to restrict the Electrical Safety Code to safety conditions only and eliminate the duplications that now exist in the two manuals. Safety legislation is new and should be tried out in the field. When the safety code has attained an experience standing equal to that of the National Electrical Code it would be good policy to consolidate the two. At present the industry should consider the one-code proposal very carefully.

* * * *

Bring Forth the Proof; Assure the Public

THE proposed investigation of the electric light and power industry by Congress is becoming less and less a topic of major interest either in Washington or throughout the industry itself. Hearings before the Senate committee on interstate commerce ended last week with indications that serious questioning had arisen in the minds of many committee members concerning the desirability of any inquiry at all, so weak a presentation did the proponents for an investigation make. However, it is evident that some investigation will be recommended—not so broad in scope as that asked for by Senator Walsh, perhaps, but thorough enough to establish fundamental facts. Indeed, since Senator Johnson of California has moved for a somewhat similar investigation of the telephone industry, it would not be surprising if the entire job were turned over to the Federal Trade Commission. That body is primarily a fact-finding commission and could, by concurrent resolution of both houses of Congress, delve deeply into all the charges, including that of lobbying, made against the public utility companies.

It is significant that Senator Walsh did not question the sufficiency of electric service or the reasonableness of the rates charged therefor. His complaint ranged almost entirely around the financial operations of holding companies. There could be detected also a lurking suspicion on the part of some of the members of the Senate committee that holding-company securities represent a great deal of "water," and, although an effort was made to show this not to be the case, it may require an exhaustive investigation to convince not only Congress but also part of the public. The utility companies made no elaborate defense. In the nature of the case perhaps none was called for. The burden of proof rested on the accusers, and the record, as we have already said, shows how weak a case they presented. None the less, the whole public must be assured that not only are the accusations made against the industry groundless, but that these consolidations and combinations of electric public utility properties are really in the public interest. The proofs abound; they must be spread broadcast throughout the land.

The Significance of the Grounding Problem

PROPER protective grounding is an active theme in the industry right now. The importance of the subject itself is heightened by the fact that the code-making machinery is under close scrutiny. The committee on Article 9 of the National Electrical Code, which has jurisdiction, has devoted much time to evolving new rules. A completely revised text has been prepared in lieu of the provisions of the 1925 code and will go before the N.F.P.A. electrical committee in February. As a supplement to the report of the committee on Article 9 there is being presented a minority report on the grounding of fixed appliances. In addition the National Electrical Manufacturers' Association has studied this subject and has issued certain definite recommended practices. As the situation now stands there are many viewpoints and the whole issue is beclouded.

Every branch of the electrical industry is concerned with grounding. Electrical men should, therefore, realize the fundamental importance of approaching this problem seriously and with caution, since the entire code-making system is involved. The success of the industry in working out this problem will stand as an indication of its ability to regulate itself. The fault lies not with any group, but probably in part with all, and the differences of opinion are not so widely apart that they cannot be reconciled in a practical compromise that will give adequate protection.

* * * *

Wired Radio Versus Space Radio —Some Commercial Aspects

AN INTERESTING problem will be presented to the executives of the power industry before very long by the conflicting commercial possibilities that will lie in the field of radio. The issue will arise over the question of which will be the more profitable for the central-station company both in dollars and in public and trade relations—to provide a service of entertainment by carrier current distributed over its domestic circuits or to push the sale of alternating-current radio sets as energy-consuming appliances to build up residence load?

There seems to be no doubt from an engineering standpoint that so-called "wired radio" will offer opportunity for the establishment of a service of entertainment delivered on power lines through special loud speakers rented by the power company. The programs may be provided by the local company; they may be delivered by wire from some distant studio, or by contract with a broadcaster they might be taken from the air and poured onto the wires. The ability of the company to sell such a service must depend upon the quality of the programs offered and the practical superiority of the service. Strenuous objections by the local radio trade to the entry of a public utility into competition with its own customers in this field will of course be encountered.

On the other hand will lie the load-building possibilities of space radio. Already it is estimated that 550,000 alternating-current radio sets are in use and 2,000,000 using other forms of current supply, all connected to central-station circuits. An alternating-current set produces about $10 a year in revenue to the power company. The alternating-current set today is sweeping the country. Supply is away behind demand, and from now on almost every radio set that goes into a wired home is going to mean load, an increase in residence consumption of about one-third of the present national average. Moreover, the existing leadership of space-radio broadcasting will not be lightly relinquished, and it is reasonable to expect that in face of this the public will naturally be slow to abandon space-radio reception. Certainly the power companies should do anything possible to build up load with alternating-current radio.

The point is this—that the relative appeal of wired radio versus space radio will in the end boil down to a simple equation. Which will be more in the public interest? Which will offer the greater profit to the utility, the net returns from an entertainment service or the revenue from alternating-current sets in general use? In the end the issue will be determined very largely on these two considerations.

* * * *

Interconnection Brings Non-Standard Transformers

INTERCONNECTION of utility systems does not make for transformer standardization during the development stage. Two-winding and three-winding transformers with tap changers on each winding and non-standard voltage ratios have been demanded of manufacturers by utility engineers. The cheapest and easiest way to make two systems operate under interconnection is to have the transformers afford the regulatory control and furnish the flexibility for reconciling differences in system voltages. Such complications as exist for these reasons can be understood and are warranted in a development stage of interconnection.

But thought should be taken to get a maximum possible degree of transformer standardization. Special features may be desirable in an individual transformer installation but may not be necessary. Nor is it reasonable to have oil, air and water cooling and combinations of these cooling methods which complicate mechanical details of transformer design so as to produce a multiplicity of special transformers. Work on transformer voltage standardization might well be supplemented by action toward building systems to interconnect with standard transformers and also by action to get a greater degree of standardization in transformer cooling methods and mechanical dimensions.

* * * *

Neon Lamps for Home Lighting

THE neon-tube sign lamp is now to be seen in nearly every city as a recent development in illumination. These colored-light signs have been adopted very rapidly as a new display element in the advertising business, and they have established their place. Speculation as to the future of the neon lamp invariably leads to a consideration of its possibilities for home lighting. The absence of glare from a concentrated light source and of the necessity for shielding resistance filaments, with consequent lessened efficiency in illumination, are clearly advantages. In addition there are possibilities of color and warmth in neon bulbs that offer attractive decorative opportunities. It may be necessary to use small permalloy transformers in the base of the neon bulbs to get the voltage required for the ionization. This type of bulb could be used in existing sockets and with present lighting services.

On the other hand, several disadvantages are apparent

which must be overcome before much headway can be made with neon lighting in the home. The low power factor and small energy consumption of neon lamps might well be considered with apprehension by utility companies. But past history shows that new developments never injure business. The neon lamp may force a rapid development of heavy-consumption household-appliance sales to offset the loss of revenue from resistance filament lighting and may add new possibilities for electric lighting in the homes. The future field of the neon lamp not only provides an interesting subject for speculation but is worthy of attention from a practical point of view, and this development will be watched carefully by all electrical men. Researches now under way may be very fruitful.

* * * *

Turbine-Blade Failures Too Frequent

THE modern turbo-generator is a splendid achievement and represents the consummation of years of development. But it will not be finished until it shall have a maximum degree of reliability. At present the chief trouble with turbines occurs from blade failures. Rows of blades fail and cause the units to be put out of service.

No basic reason has been found for blade failures, and no general rule covers the location of the failures. It is the intermediate stage blading on the spindle which gives the trouble, so that size of blade or high-pressure effects have little bearing. It may be a vibration effect, but a more reasonable explanation is that it is caused by a combination of vibration, expansion and contraction and change in blade structure. Alloy blades have splendid characteristics on test, but any alloy must undergo life tests before it can be said to have proved itself. Some of the alloy blades may change their structure when placed in turbines or may undergo a fatigue which makes their life limited. Research work on steel alloys is needed to eliminate any chance of these effects causing turbine failures. In some cases also improper plant operation, and not inherent blade defects, may cause blade failures. It would be well to make careful studies of all blade failures, including micrographs of the metal, so that complete data may be had to improve turbine operation.

* * * *

Where Light Means Life

NOWHERE is the work of the illuminating engineer more important than in the hospital operating room. Recent improvements in the lighting of these places by the use of prismatic refractors backed by high-powered lamps point the way toward new standards of practice in this vital field of service. Tests reported by H. Logan to the Lighting Engineers' Club of New England at a recent meeting in Worcester show that approximately six minutes is being saved in operations formerly averaging about twenty minutes by the provision of the above type of illumination, with its resulting excellence of distribution uniformity, high intensities at the edges and interiors of wounds and reduction of eye adjustment strain on the part of the surgeon when looking away from the operating table for instruments or supplies or for other reasons. What this means in the reduction of the period of anæsthesia and surgical shock need not be elaborated here, but the progress recorded suggests unrealized possibilities in many fields where analysis of work cycles coupled with a willingness to spend money for desirable increased intensities of illumination properly directed and distributed offers attractive rewards.

* * * *

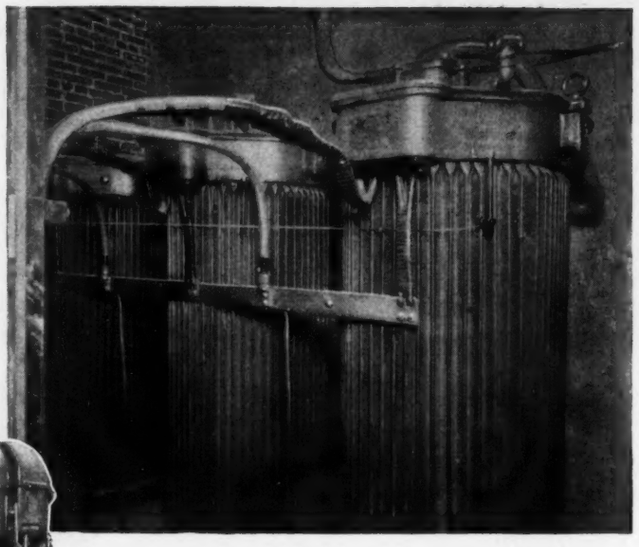
Obligations Inherent in the Social Contract

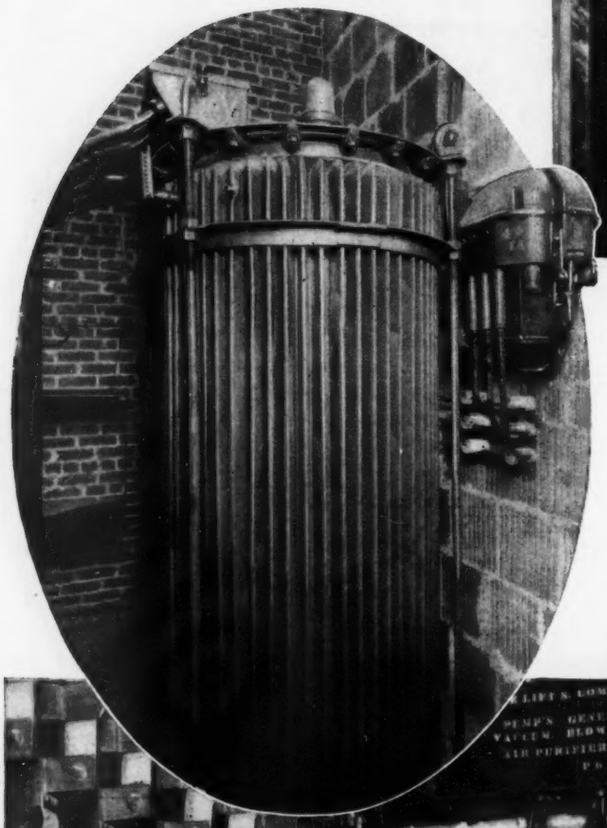
ROUSSEAU did not have the central-station industry in even the innermost recess of his mind when he entitled the book that was the "Uncle Tom's Cabin" of the French Revolution "The Social Contract." He was thinking of a supposed contract between the individual and the state and of the mutual obligations of the two under that contract. Rousseau has been dead for a century and a half. His ideas, perhaps different in their fruition from his conception of them, had wide influence in their day. But the social contract has enlarged its scope. If it is still a binding agreement between the individual and the state, it is more than that. It is the unstated, and often unrecognized, obligation that the units of industry, whether personal or corporate, owe to the social organization of which they are a part. It does not necessarily follow that this obligation is of the kind to be discharged to the state in the forms of taxes and loyalty; it may be worked out in commercial relations with other members of organized society.

The agency that will bring the benefits of electric service fully into the American home, that will make farm life as comfortable and convenient as city life, is the electricity supply system. The development of electric utilities to the present day has been a history of the unequal sharing of burdens of costs. There will always be some among the total number of customers of any electric utility who, in strict equity, get a little more than they pay for and some who pay for a little more than they get. It is in the very nature of the business that this should be true. On any system it costs less to serve a residence customer within a block of the power house than one ten miles away. Yet both pay the same rate. One is paying part of the cost which, strictly, is chargeable to the other. If the customer near the power house ever took time to think about the matter, no doubt he would cheerfully accept the situation as a part of his social duty to the man who lives farther away. It takes all the residence customers, all the commercial customers, all the industrial customers, all the individual members of these groups, in any given area of city or country to permit the electricity system or systems serving them to reach the highest point of economic efficiency.

Now, in order to extend electric lines to six million more farms in the United States, to strengthen distribution systems for increased service to domestic users, to do a hundred things that will result in the full and complete electrification of our country, the electric utilities must have the co-operation of every element in the social organism. That co-operation must manifest itself in the use of electricity supplied from the systems. It is the duty of every element of society to promote agencies that are working for the progress of society. If any element or individual fails in that duty, it or he is failing in the obligations of the modern social contract which, except for the enlargement of its scope, might be construed as pretty much the same as when it was explained by Jean Jacques Rousseau.

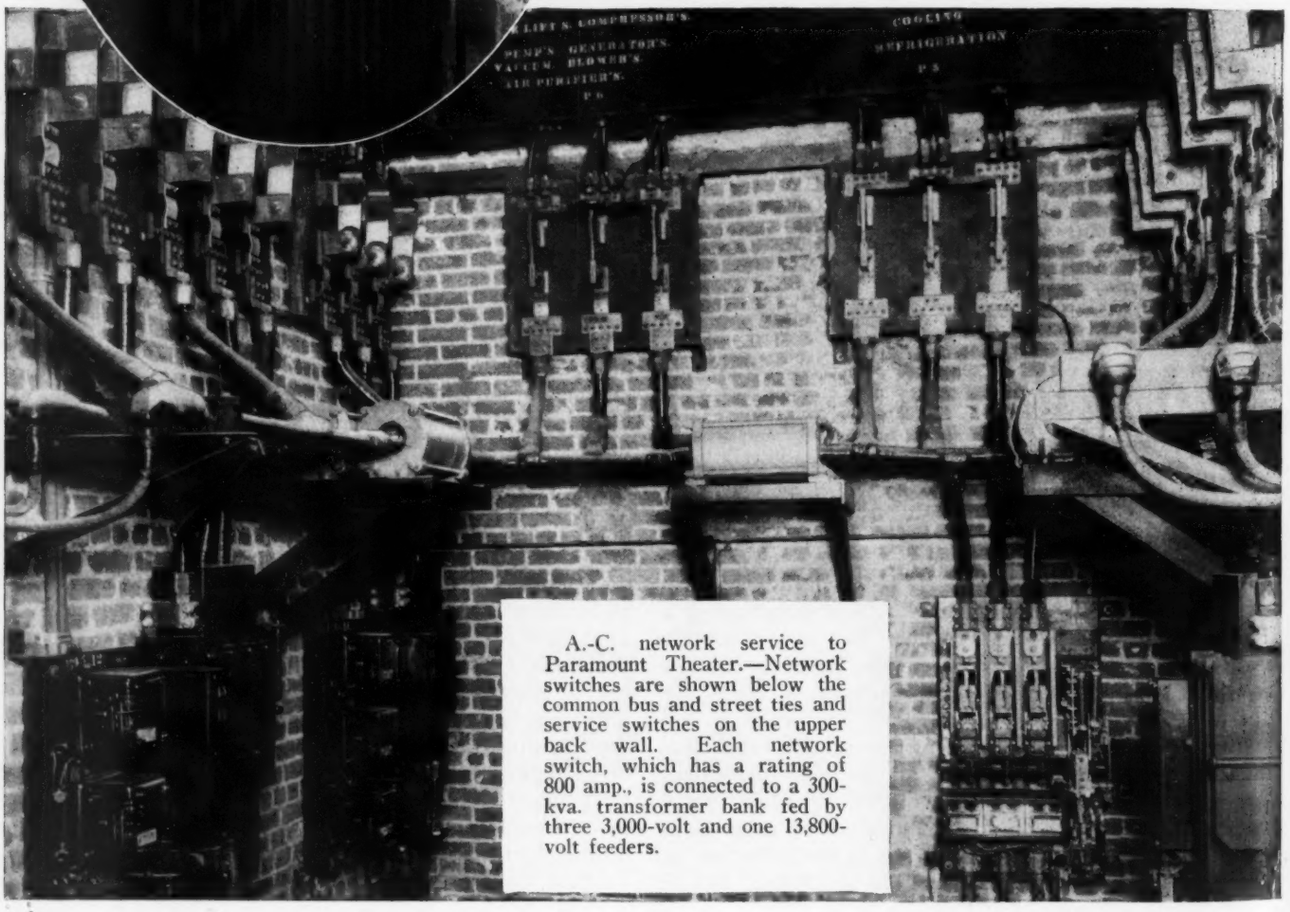
A.-C. Network and 120/208-Volt Service in New York City





ECONOMIC justification of alternating-current service has not deterred utilities in seeking means to make it just as reliable as the Edison direct-current network system. With this purpose in view, the network idea is being adopted at many places throughout the United States and the United Electric Light & Power Company is one of the pioneers.

Above and in oval—Bank of three 100-kva., single-phase transformers and one 300-kva., three-phase unit connected delta on high side to 13,800- and 3,000-volt feeders respectively to supply 120/208-volt, three-wire service.



A.-C. network service to Paramount Theater.—Network switches are shown below the common bus and street ties and service switches on the upper back wall. Each network switch, which has a rating of 800 amp., is connected to a 300-kva. transformer bank fed by three 3,000-volt and one 13,800-volt feeders.

Power in National Defense

Mobilization of power resources planned. Co-operation of utilities needed. Field surveys under way. Basic plans outlined for war service

By Major Edward C. Kelton
Corps of Engineers U. S. Army

On Nov. 10, 1927, Col. Hanford MacNider, the Assistant Secretary of War, addressed the Kiwanis Club at Chicago as follows:

"Along 500 miles of broken fields and shattered villages, from the North Sea to the boundary lines of Switzerland, the deep, sullen roar fell away. Five million earth-colored creatures rose uncertainly and tried to stand up again like men. There was a new and strange throb in the breast of every one of them. This was the Armistice. It was over.

"Across the ruined countryside, where a moment before there had been no sign of life, now stood upright once more what was left of the flower of half of the great nations of the earth. The fleeting exultation of victory, of a job well done, the black pangs of defeat, the thought of a bannerless return to the fatherland, all these came and passed. Helmets were pushed back or clattered to the ground in the strange new silence. Eyes that had seen all that hate, death, hell on earth could muster met across what an instant before had meant all those things and more. The long lines of men looked curiously at the sky, at the surrounding devastation, at each other. Resentment, at least as between man and man, was already dying away.

"Across that tired and unhappy and broken land came the faint cheering of men—faint as if afraid that this could not be real. Not a cry of release from peril, or hardship, or pain, but as of the lifting of a curse which had been laid upon the world. It was over.

"If there was in those men's eyes a thing that might be read, it was: 'So that was war. Well, God spare our sons and their sons. We want no more of it.' And so those men stood, swaying a bit on unsteady legs, confused at the new stillness of things, Consciously or unconsciously, a vow wrote itself across the soul of every one of them. There must be no more of war.

"Nine years ago it was, this day. Let those of us who rose from the mud of that western front, who served with the colors of our country wherever it may have been, give an account of ourselves. What have we done about it? And what do we intend to do?"

Many men such as Mr. MacNider was addressing in Chicago on Armistice Day are in the ranks, high and low, of the electrical industry; they are in the central stations, in the offices, out on the lines and in the great establishments manufacturing electrical equipment; from hard and bitter experience they understand war; they do not see anything romantic or beautiful in it; they think of it only as something to be avoided or to be terminated as promptly as is consistent with national honor. On the one hand, from their war experience they know the terrible effectiveness of modern weapons in the hands of trained men; on the other hand, from their every-day life they know the research, science, skill, time and effort that go into the production of those weapons and the enormous amounts of power that are required in their rapid manufacture. They are prone to analyze the power industry as to what it did during the World War and what position it is in at present to meet an emergency.

Power Shortage in Last War

To some it may come as a surprise to learn that ten years ago there were serious power shortages in several parts of the country; that in the Niagara Falls district the shortages ran as high as 90,000 hp.; that the situation there was so desperate that the United States was forced to deliver coal to Canada in exchange for electrical power at a time when every train of coal crossing the International Bridge almost caused a riot among the Americans who were unable to obtain enough to heat their houses; that in certain sections it was deemed necessary for the government to take over the entire electrical output of all central stations; that just before the Armistice the situation had reached the state where the power section of the War Industries Board had introduced in Congress and was pressing for the passage of a bill calling for $200,000,000 to aid the power companies to meet the demands being put upon them by essential war industries. These conditions were not the result of any disinclination on the part of the electrical industry to aid in the war work. They were co-operating 100 per cent, but even with expansion programs rushed to completion, with interconnections hurriedly made and with every stand-by plant put in operation, no matter how inefficient it might have been, the totals available were not sufficient. Fifty and 75 per cent expansions of output over whole sections were achieved, but still the power section estimated the shortage in the seven districts it surveyed to be 236,800 hp. Finally, with certain curtailments of the less important industries, the power situation was met satisfactorily but with such a small margin of safety that only the Armistice avoided even more critical shortages in 1919.

Since the World War the electrical industry has been revolutionized and, what is more important, it has revolutionized every other industry. The table on page 241, recently published by the National Industrial Conference Board, indicates the extent of the electrification.

There seems to be no diminution in the replacement of heavy, back-breaking human effort by machines driven by electrical energy. In the two years from 1923 to 1925, according to the biennial census of manufactures, the horsepower per wage earner jumped from 3.8 to 4.3. It is now probably 4.8 hp. per wage earner. This has

released many thousands of workers for other lines of endeavor. It has permitted the employment of women in places where the arduousness of the work limited their usefulness. It has, furthermore, made the individual worker more effective, so that, in spite of a reduction of 496,000 wage earners in manufacturing establishments from 1923 to 1925, the volume of production was not decreased. In fact, certain figures now indicate that the average American manufacturing wage earner can produce 49 per cent more than he could in 1889. The reason is easily discovered—the use of machinery; but, more important still, the electrification of industry.

Within the electrical industry itself the technical and organizational developments have been no less remarkable. One ton of coal now does the work of three. Economic transmission distances have been increased, safety and reliability of service and improved standardization of equipment have resulted in simplicity, increased usefulness and convenience to the consumer. Electricity has been applied to an ever-widening field of useful purposes. Reciprocal agreements between companies, and other efforts, have raised load factors to points not dreamed of in 1917.

Goal Not Yet Reached

The goal is not yet reached. In spite of an increase of 17 per cent in the last three years, industry is still only 73 per cent electrified. Electric furnaces have not yet come to their rightful position; the electrification of the railroads has just begun; the Diesel electric drive for highway, rail and water transport lags behind that of several other countries, in spite of its proved efficiency; the market for electricity for house heating has not been scratched, in spite of the fact that the earnings from byproducts that now go up every stack, if turned to reducing rates for service of this type, could in a few years meet the competition of dirty, inconvenient coal- and even oil-burning service. This will be even more true when the present flush production of petroleum falls, as it must, in a few years. Research and development will continue to place electric energy in every phase of our economic life.

If all this be true, why should the War Department or the government be studying the problem of the mobilization of industries of the country? Why should it be making attempts to obtain the co-operation of the power industry in an effort to have it ready for instant mobilization in case of a war? It is because Congress and its defense agencies, the Army and Navy, as well as many leaders of industry, foresee conditions that are quite different from those that obtained at the outbreak of the World War. These may be outlined briefly.

Primarily, in the case of a major emergency, the demand upon industry will be far greater and much more intense than it was in 1917. In those dark days the War Department was practically without a military plan of mobilization and quite without an industrial mobilization plan. Five or six months passed before the decision was finally reached, calling for the mobilization of 3,000,000 men. Mobilization moved slowly. Orders for munitions were not issued promptly. Now, however, plans are available not only for the mobilization of the number of men required to meet a major emergency but also for the prompt placing of orders for the billions of dollars' worth of supplies required to put and maintain that army in the field. These orders will be placed immediately upon the outbreak of a major emergency. Industry will start to execute the tasks that have been outlined in time of peace. True, efforts will be made to limit the production of non-essential industries and to turn their efforts to war work, but the final result will be an increased industrial activity, which, of course, means increased demand for electrical power.

Second, we little realize the extent of mechanization required in another emergency. Tanks, gas containers, bombs and a few airplanes upset our calculations and strained our unorganized industry in the World War. We visualized and had planes carrying 200-lb. bombs. We had perhaps one plane for every 5,000 of our soldiers in France; who can say that it will not be one to 50 the next time, with each one of them carrying 500-, 1,000- or 4,000-lb. bombs? Rates of artillery fire will be much greater. Power is required to manufacture the planes, the bombs, the gas, the shells, as well as the trucks, the locomotives, the steel, the machine tools, the prime movers, and also to mine the coal and iron ore required in producing and transporting those products to the front. The undoubted increased mechanization of the Army is reflected back and back in increasing waves to the ultimate demand for power.

Again, the very efficiency of the power industry, in raising the load factor, is filling up the valleys in the load curves that were of such importance in meeting the war demand in 1918. Reciprocal operating agreements are cutting down on total reserve generating capacity. With every such agreement it becomes possible for one or both power companies to put off for one or two years the installation of new units or the building of new plants. Reserve stand-by plants may be scrapped. All this is good business. Load factors are rising, overhead costs are being reduced and the country as well as the industry is benefiting from the practice. Still the fact remains that the reserve available to meet an emergency is being cut and cut. Increased efficiency and co-operation promptly made thousands of horsepower available in the World War. Efficiency and co-operation under the stimulus of a national emergency are quickly mobilized, but the making of electrical equipment is not so promptly done. Certainly we should not slacken up on our struggles for efficiency and economy, but we should realize our reserves are being cut and not sink back with a false feeling of security. Under the present favorable financial conditions of the public utilities, the danger is not extreme, but a period of hard times and of intense retrenchment might promptly make the situation critical. Furthermore, the danger appears in its true light when it appears certain that in time of war the central stations, perhaps already breaking under the war demand, will find themselves unable to obtain equipment for expansions because of large direct war orders that may require preference over civilian demands for normal expansion. A little margin of capacity is quite as desirable for national safety as for local protection against interruptions in service. One prevents annoyance and delay; the other may prevent national disaster.

In a major emergency the demands of the Army and Navy for munitions will be extremely large. Theoretically the Navy is more nearly prepared for instant action than the Army. It is well recognized that the Navy cannot go to sea without ships and that it takes two or three years to build a battleship. Hence the Navy's demand upon industry for supplies and equipment will scarcely be as great as that of the Army. Therefore the Army has the paramount interest in seeing that adequate supplies of power are available for the production of its war munitions. Certain items for the Navy are of equal

importance, but the total demand for power for munition purposes naturally becomes of prime interest to that agency whose success and whose very existence depend upon it.

National Defense Act Passed

It may have been some such reasoning that caused Congress in 1920 to pass the national defense act charging the Assistant Secretary of War with the supervision of the procurement of all military supplies and other business of the War Department pertaining thereto and with the assurance of adequate mobilization of material and industrial organizations essential to war-time needs. Be that as it may, the War Department has felt its responsibility, in connection with other industrial mobilization studies, to survey and to ask the power industry to prepare itself to meet the demand that would be placed on it in time of war.

Since 1921 the Corps of Engineers of the Army has been conducting a survey of the power facilities of the country. It has obtained fairly complete information concerning all central stations of 5,000 kw. or over, such as capacity and characteristics of generating stations and transmission lines, interconnections between systems and finally data as to proposed extensions and improvements both under expected normal expansion and under maximum possible expansion in case of emergency. In all cases the co-operation of the members of the central-station industry with the War Department has been most hearty and data even of the most confidential nature have been given freely to the Corps of Engineers, with the understanding, of course, that such information was to be held strictly confidential. With these data much progress has been made in preparing to place our industrial load in such a way as to avoid overloading any particular section. The surveys have also listed the items of major equipment necessary for the expected expansion program. This has enabled the War Department to visualize one of the major manufacturing loads and will insure the essential needs of the central-station industry for equipment being cared for.

However, with the best of planning, shortages of power may occur. It occurred in the World War and may occur again. As a result the entire output of several large plants was taken over by the President of the United States. Such drastic action was necessary not only for the successful prosecution of war but for the protection of the rights of power companies in their relation with their customers. The power was needed for war purposes and by taking the entire output and then distributing the excess over the essential uses the demands of most of the users were met. It is only too easy to forget that such extreme conditions existed just ten years ago. It is only too easy to say that we shall never be in a position like that again. However, the War Department feels that it would be failing to do its duty if it did not attempt to take some steps to avoid such emergencies.

On June 8, 1927, the Secretary of War, Dwight F. Davis, presented a "Plan for the Co-ordination of the Use of Power in Time of War," at the annual convention of the National Electric Light Association at Atlantic City.

The plan had previously received the consideration of many leaders of the central-station industry. It represented their views and was acceptable to them in principle. It was the culmination of more than a year's co-operative effort at evolving some scheme that would insure the effective utilization of the power facilities of the country. Full extracts of Mr. Davis' address were given in the Electrical World of June 11, 1927. However, it might be well to restate the principles upon which the scheme is based. They are:

"1. The government should not take over any plant or power system unless necessary to insure the efficient prosecution of the war.

"2. No additional control should be exercised in regions where power is adequate for present and immediate future needs, both civil and military.

"3. When shortage of power for essential needs exists or is threatened, the government should take over the entire output of the plant or plants in the locality and apportion the power output to users in the best interests of the United States. This action should set aside all existing contracts for the supply of power with which such action conflicts.

"4. If the preceding methods fail to obtain sufficient amounts of power, the government should undertake actual operation of such plant or plants.

"5. The existing organizations of any companies taken over should be utilized in their operation, in order to make full use of the experience, training and skill of their personnel."

EXTENT OF ELECTRIFICATION

Year and Industry Group	Total Primary Horsepower	Electrical Primary Horsepower: Motors Driven by Purchased Current	Electrical Primary Horsepower: Motors Driven by Generated Current	Electrical Primary Horsepower: Total Electrical Power	Per Cent of Total Primary Power
1914	22,307,189	3,897,248	4,938,722	8,835,970	39.6
1919	29,297,963	9,260,449	6,965,174	16,225,623	55.3
1923	33,056,870	13,332,780	8,819,217	22,151,997	67.0
1925	35,772,628	15,868,828	10,254,745	26,123,573	73.0

Following the enumeration of these principles, Mr. Davis then outlined the essence of such a plan. Before considering it, however, it is well to remember that the steps that may be necessary in time of war are a far cry from regulation by the government in time of peace. The two are separate and distinct and are not based upon the same premises. In time of peace the economic, political and social ideas of the nation must govern. In war some of the rights and privileges must give way before the greater responsibility of the nation to repulse the onslaughts of the enemy.

Executive Feature of Plan

The plan calls for the selection by the President of the United States of an executive assistant, to be known as "the emergency power director," who would be responsible for the effective utilization of the power facilities of the country. The emergency power director would be assisted by an executive committee, the majority of the members of which would be nominated by the National Electric Light Association and approved by the emergency power director. These men would serve in a civilian or military capacity. The committee would serve under the direction of the emergency power director and would be the medium through which the mobilization and co-ordination of the power systems would be carried out and effective co-operation secured.

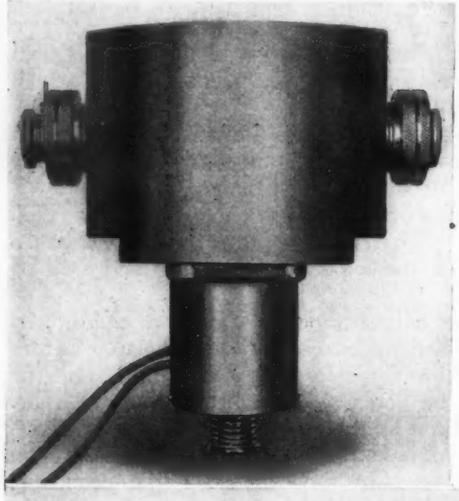
The plan was left in most general terms; it was designed to give necessary authority to the emergency power director to obtain the best results from the power industry; it had for its basic principle that the executives of the industry were the best able to bring about those results, but that they would need the added authority of

the President under the law. The plan provided for this by the appointment of the emergency power director. Thus in case of war, if the situation becomes sufficiently threatening, we shall promptly have an organization, vested with legal authority, in possession of basic data as to requirements and resources of electrical power as is now being gathered by the Corps of Engineers and other agencies, ready to give every aid in co-ordination to the end that the power resources of the nation may be used to their maximum for war purposes.

Improved Cup for Testing Oil

By J. B. Wallace
Detroit Edison Company, Detroit, Michigan

TO FACILITATE emptying the standard oil test cup manufactured by the Westinghouse Electric & Manufacturing Company (style No. 263621), the laboratory of the Detroit Edison Compnay once tried to support it on two horizontal metal bars on which the



OIL TEST CUP WITH SLEEVE TYPE DRAIN VALVE

electrodes could be rolled, but this arrangement was found objectionable. The entire weight of the cup, 6½ lb., rested on the electrodes, with consequent danger of misalignment. When the cup was rolled over for emptying, the impurities in the bottom of the cup were thrown over the gap and tended to remain on the electrodes, unless rinsed repeatedly. A large pan beneath the oil cup was necessary to catch the oil when dumped.

To eliminate these difficulties, a valve arrangement was developed. This consists of a hollow sleeve valve in the bottom of the oil cup, which, when closed, is slightly below the bottom of the cavity. When open, the sleeve is raised sufficiently to open ports cut into its side through which the oil is discharged. The sleeve valve is normally held closed by a spring, in addition to gravity.

A solenoid coil is concentric with the sleeve and is mounted on the bottom of the cup. The sleeve is lifted by the coil when the circuit is closed, opening the valve against the spring, permitting the oil to drain out. The cup is rinsed between samples with high-test dry gasoline and dried with a hot-air hand-blower. As set up in the laboratory the cup is mounted permanently on a micarta table top set on wall brackets. A waste pipe receives the oil discharge from the lower end of the valve sleeve. The solenoid terminals are brought out to a separable connector which is opened while test potential is being applied.

With this arrangement the electrodes support no extra weight, the oil and impurities are drained down and away from the electrodes, rendering repeated rinsing unnecessary, and a permanently mounted stationary test cup is made possible. This facilitates setting the test gap exactly. The valve arrangement was conceived and designed in the testing division of the operating department and was applied to the standard cup by the electrical division of the Detroit Edison Company shops.

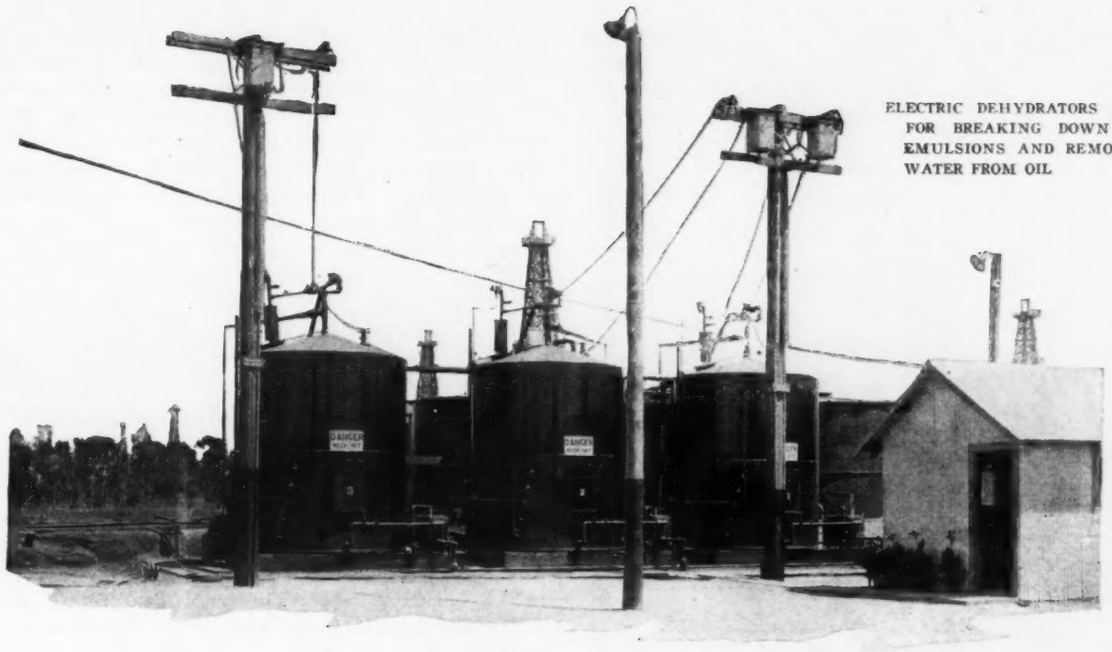
Costs of Generating Plant Building

IN connection with the development of a New England central station a cost analysis was recently made by Jackson & Moreland, Boston, Mass., bearing upon the 1927 investment outlay required to duplicate various generating plant buildings, and from this analysis the accompanying tabulation has been prepared for use in estimating construction costs.

GENERATING PLANT 1927—BUILDING COSTS
(Excluding all overhead)

BOILER PLANT	
Building "A," boiler house, 77 ft. x 146 ft. x 72 ft. high.	$321,656
Building "B," boiler house extension, 78 ft. 6 in. x 77 ft. 6 in. x 72 ft., with monitor 42 ft. x 77 ft. 6 in. x 18 ft. high	150,984
Building "C," boiler house extensions, 78 ft. 6 in. x 87 ft. 6 in. x 73 ft. high, with monitor 42 ft. x 87 ft. 6 in. x 18 ft. high	182,441
Lighting equipment for above three buildings	7,051
Heating equipment for above three buildings, including 460 sq.ft. radiators, piping, valves, etc	753
Plumbing	9,356
Contractor's compensation	33,612
TURBINE HALLS	
Building "A," turbine hall structure, 61 ft. x 130 ft. x 69 ft. high	166,539
Building "B," extension 61 ft. x 46 ft. x 69 ft. high, with monitor 26 ft. x 35 ft. 6 in. x 9 ft.	99,569
Building "C," turbine hall extension, 61 ft. x 92 ft. 6 in. x 69 ft., with monitor 26 ft. x 75 ft. x 9 ft	85,746
Lighting equipment for above three building units	3,348
Plumbing equipment for drinking-water system	279
Contractor's compensation	17,774
CONTROL ROOM AND OFFICE BAY	
Building "A," 4 stories, 27 ft. x 125 ft. x 50 ft. high, with monitor 5 ft. 6 in. x 120 ft. x 4 ft. high	70,330
Building "B," extension, three stories, 27 ft. x 46 ft. x 38 ft. high, with skylight 5 ft. x 32 ft. x 2 ft. high, and automatic passenger elevator	20,990
Lighting equipment for above buildings	2,647
Heating equipment for above buildings	2,654
Plumbing equipment for above buildings	5,560
Contractor's compensation	5,109

In general, the buildings and extensions covered embrace structures with foundations of concrete mat on wood piles, steel frame superstructure with brick exterior finish and tar and gravel roof.



ELECTRIC DEHYDRATORS USED FOR BREAKING DOWN OIL EMULSIONS AND REMOVING WATER FROM OIL

Oil Field Power Costs

Electric pumping data given. Effectiveness of electric dehydrators shown. Electric drilling expense totals but half of that for steam

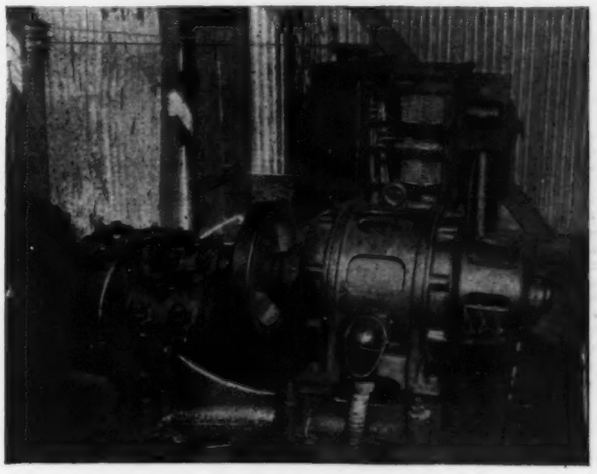
ALTHOUGH electric power was slow to invade the field of oil production, rapid progress has been made during the past few years, until now there are many fields using electric power exclusively. One such field in southern California, visited by a representative of ELECTRICAL WORLD, furnished valuable data on electric pumping and drilling costs. This was the field of the Chanslor-Canfield Midway Oil Company at Torrance, Cal., near the city of Los Angeles.

In this field there are 165 wells electrically pumped by individual motors. Records for the month of June 1927 give the following information relative to pumping:

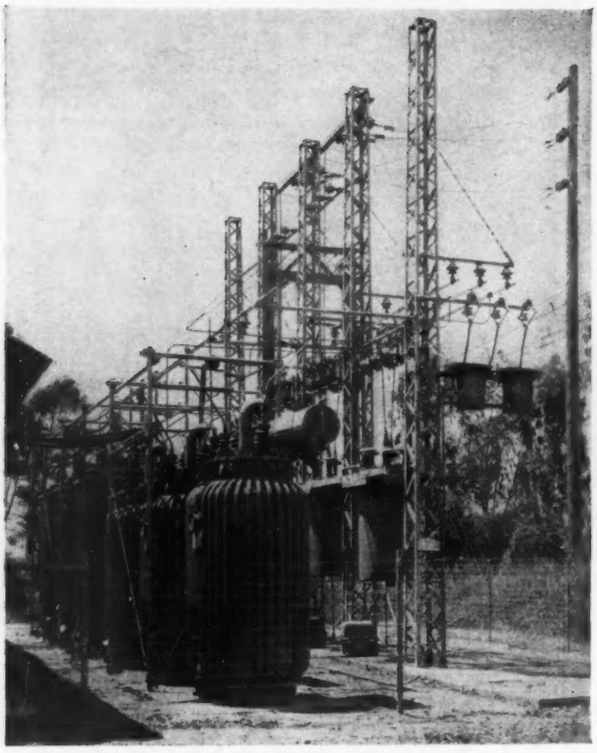
Total barrels pumped	271,796
Total kilowatt-hours consumed for pumping	907,486
Average kilowatt-hours per barrel pumped	3.34
Average cost per barrel for power, cents	2.7
Average rate per kilowatt-hour, cents	0.81
Average pumping depth for all wells, ft.	2,890
Maximum power demand for all purposes, kw.	1,723

Since all pumping in this field is done electrically, no comparative gas or steam pumping costs are available. However, from checks made in another field operated by the same company it has been found that in making a new installation, electric pumping with power at 1 cent per kilowatt-hour is considerably more economical than gas engine pumping using 900 B.t.u. gas that could otherwise be sold at 10 cents per 1,000 cu.ft. One point strongly in favor of electric pumping is that about one-third less labor is required to take care of the pumps. If the 165 wells in the Torrance field were pumped with gas engines, nine men per shift would be needed to attend to the pumps instead of three men now used for the electrically driven pumps.

Two general systems of electric pumping are used in the oil fields; one is the individual motor drive, as in the Torrance field, the other is the so-called jack system, whereby the walking beam of the well pump is actuated by a cable attached to an eccentric motor-driven ring, centrally located with respect to six to eight wells. The latter system has the advantage of lower first cost and lower pumping cost as well, but necessitates the use of portable well bailing and cleaning rigs, which partly



INDIVIDUAL MOTOR DRIVE ON OIL WELL PUMP



SIX 1,000-KVA. TRANSFORMERS FED FROM TWO 15,000-VOLT LINES SERVING SOUTHERN CALIFORNIA OIL FIELD

offsets the advantages of the jack system. However, the determining factor in choosing between the two systems is not in the matter of first cost or pumping cost, but in the condition of the wells in the field. If the field is comparatively new and the production is high, as is the case in the Torrance field, and the wells require frequent cleaning, then individual motor-driven pumps have been found best and most economical on account of the expense of cleaning and bailing and pulling casings with portable rigs. The jack system is generally applicable only to older wells of low production.

In the Torrance field, where individual motors are used, the motors are of the double rated type, having a rating of 15 hp. at 480 r.p.m. for pumping and 25 hp. at 960 r.p.m. for bailing or cleaning or pulling casings. Tests show that the average demand of the motors when pumping is from 6 to 8 hp. One of the accompanying illustrations shows the motor and control apparatus for an individually driven well pump. All motors for this purpose are rated at 440 volts, three phase, and are of the variable-speed type. Service enters the pumping shed through conduit from overhead lines. Protection consists of a main line safety switch and oil circuit breaker with overload trip. Control apparatus consists of a cam-type controller for changing from six to twelve poles on the motor and a drum controller for varying the speed of the motor. The large counterbalanced wheel with crankshaft which operates the pump walking beam is driven through reduction gear and chain. The band wheel on which the crank is mounted is counterbalanced to give as nearly a uniform duty cycle on the motor as possible.

Electric Dehydration

A few years ago it was discovered that passing a high-voltage alternating current through oil emulsions would cause the minute particles of water to combine, forming larger and larger particles of water until globules are formed, after which the water is precipitated. This method of dehydration is patented and is now quite widely used by oil companies. One of the accompanying illustrations shows three petroleum rectifying dehydrators in the Torrance field. These dehydrators are purchased from the manufacturer, but are operated on a royalty basis at so much per barrel of oil treated.

For the month of June, 1927, 77,542 bbl. of oil was treated in the Torrance field, requiring 6,482 kw.-hr. of electrical energy, making the average cost per barrel for power 0.07 cent. Two test runs were made after the installation of the dehydrators to determine their effectiveness. The first test was on a sample of oil with high emulsion content. The data on this test follow:

	Before Treating	After Treating
Specific gravity (deg. Bé.)	22.63	24.13
Per cent sand	0	0
Per cent free water	0.2	0.2
Per cent emulsion	15.4	0.4
Per cent total foreign matter	15.6	0.6

Another test run on an oil sample with low emulsion content gave the following results:

	Before Treating	After Treating
Specific gravity (deg. Bé.)	21.78	23.55
Per cent sand	0	0
Per cent free water	2	0
Per cent emulsion	4.05	0.4
Per cent total foreign matter	6.05	0.4

This method of treatment has not been found to be so effective where the mud content in the oil is high.

Electric power is now widely used for main line pumping, or shipping stations as they are termed by oil men. At the Torrance field the output of the field is handled

COMPARATIVE STEAM AND ELECTRIC OIL WELL DRILLING COSTS
(Using Hild differential electric drive)

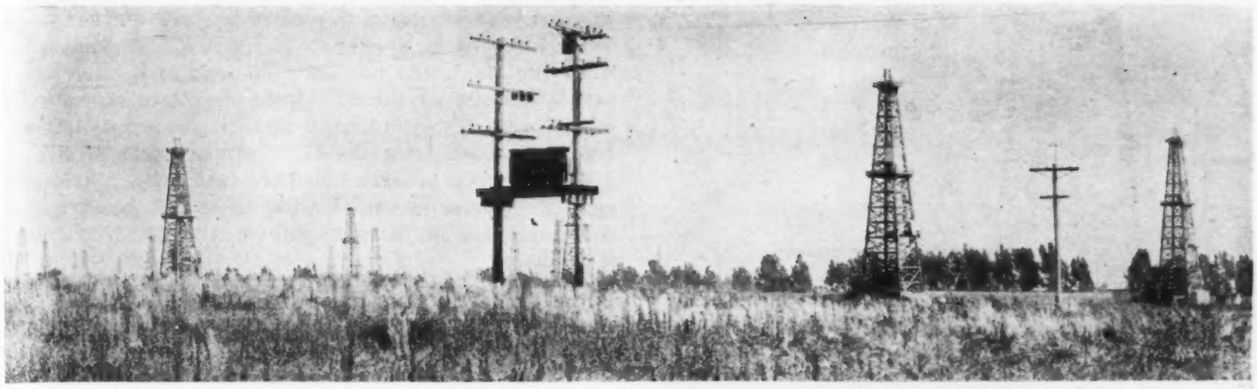
	Feet Drilled	Drilling, Days	Feet Drilled per Day	Twist Offs	Power Cost	Power Cost per Foot Drilled	Power Cost per Day
Steam	7,150	72	99.3	4	$1,154.77	$0.162	$16.04
Electric	7,075	75	94.3	2	608.36	0.086	8.11

Equipment Cost and Fixed Charges

	Wooden Derrick	Drilling Machinery	Supporting Equipment	Totals — Without Derrick	Totals — With Derrick	Depreciation Rate Per Cent	Depreciation, Not Including Derrick — Year	Month	Day	6 Per Cent Interest on Investment Including Derrick — Year	Month	Day
Steam	$3,411.83	$3,740.62	$7,564.55	$11,305.17	$14,717.00	33⅓	$3,768.39	$314.03	$10.47	$883.02	$73.59	$2.45
Electric	3,545.73	15,562.18	3,420.52	18,982.70	22,528.43	20	3,796.54	316.38	10.55	1,351.71	112.64	3.75

Summary—Daily Charges (Fixed and Operation)

	Fixed Charges — Depreciation	Fixed Charges — Interest	Extra Labor	Power Cost	Total
Steam	$10.47	$2.45	$15.75	$16.04	$44.71
Electric	10.55	3.75	.....	8.11	22.41
					$22.30



OIL FIELD TRANSFORMER INSTALLATION WITH RADIATING DISTRIBUTION LINES FOR SERVING INDIVIDUAL WELL PUMP MOTORS

by two motor-driven pumps. One of these is a 5x12-in. plunger pump driven by a 125-hp., 440-volt motor. Records for this pump, which is considered the most efficient, for June, 1927, showed:

Total barrels of oil pumped	121,932
Total kilowatt-hours used	20,140
Total cost for power	$165.55
Pumping cost per barrel, cents	0.136
Total hours operated	464.17
Average barrels pumped per hour	263

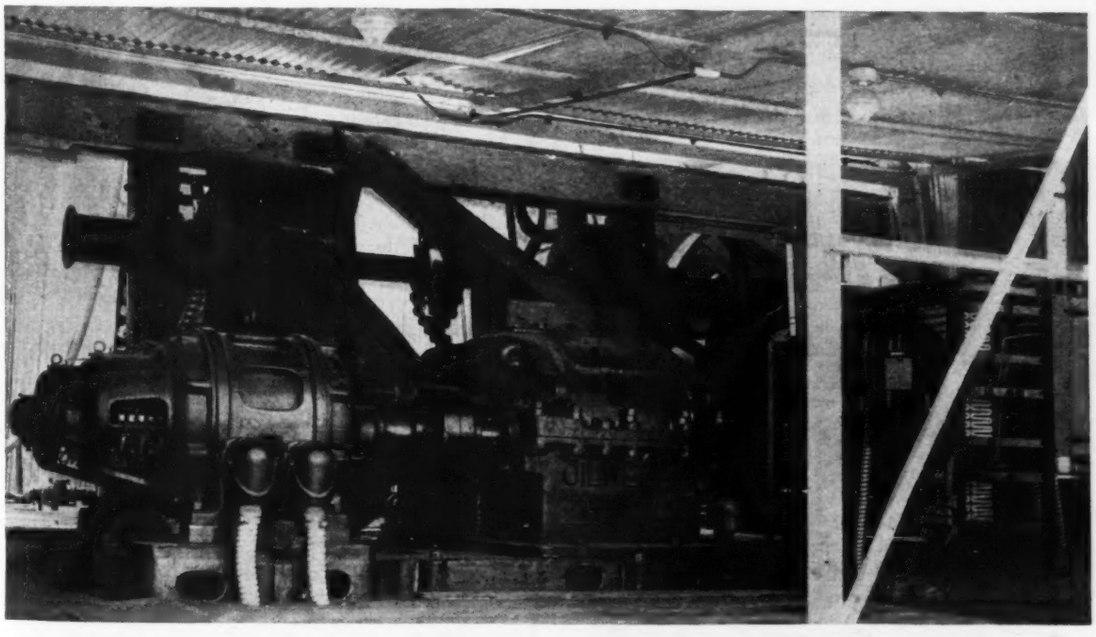
Pumping head varied from 100 lb. to 700 lb. per square inch. A test on this pump showed that it was capable of pumping an average of 288 bbl. of oil per hour against pressures up to 700 lb. per square inch at a cost of 0.1 cent for power, as compared with a cost of 1 cent per barrel of oil pumped for fuel alone when using a gas-fired steam boiler and steam engine-driven pump. All of the several types of pumps have been used for pumping oil, but experience shows that for general oil-field conditions the plunger-type pump is the most satisfactory and efficient. At refineries where comparatively clean oil is handled the screw-type pump is quite popular.

Electric drilling has been found so satisfactory and economical that steam is no longer considered except by those of the old school who are prejudiced. Records kept on two wells drilled with steam power and two drilled with electric power using the Hild differential drive at the Torrance field showed strikingly the economy of electric drive. Comparative data for the two methods of drilling are given in the accompanying tables. From these it will be seen that the total feet drilled by the two methods was practically the same and that under these conditions the net daily drilling cost, all items included, was $44.71 for steam and $22.41 for electric drive, or, in other words, steam-drilling costs were almost exactly double the electric costs.

Temporary power is supplied for the electric drilling rig by three 75-kw., 2,300/440-volt transformers mounted on a sled and inclosed by a wire screen as shown in one of the accompanying illustrations. The three-phase overhead line, which is later to be used for supplying the 440-volt pump motor, is used as a 2,300-volt circuit during drilling operations; thus temporary work for power supply is kept to a minimum.

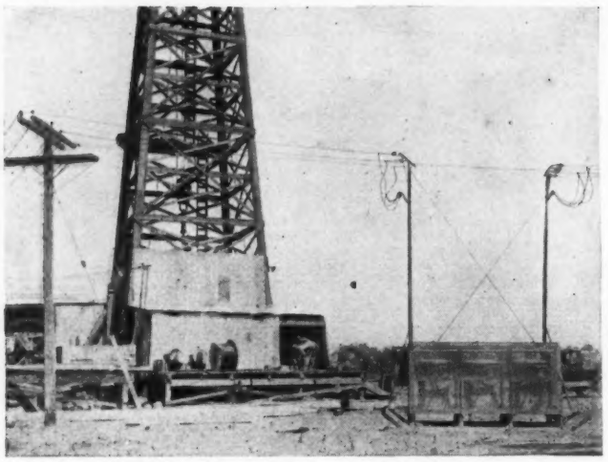
Other illustrations show the Hild differential drive and the direct motor-driven mud pumps used in electric drilling operations.

Power for the Torrance field is purchased from the Southern California Edison Company at a centrally



HILD DIFFERENTIAL OIL WELL DRIVE

Two 15-30-hp., 440-volt motors operate the drill through suitable reduction gears and chain drive. A cam-type contactor changes the motors from six to twelve poles. Nine points of speed control are obtained by a drum controller.

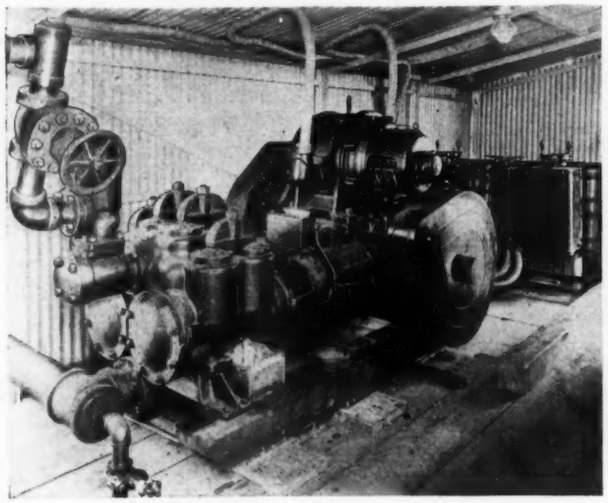


TRANSFORMER BANK MOUNTED ON SLED SUPPLIES TEMPORARY POWER FOR ELECTRIC OIL WELL DRILLING EQUIPMENT

located substation, which is shown in one of the illustrations. The station contains six 1,000-kva. transformers fed from two 15,000-volt lines from different substations to insure uninterrupted power supply in so far as possible. The reason for having so much transformer capacity for a load of less than 2,000 kw. is so that if anything should happen to one 3,000-kva. bank, the other is available for carrying the load while replacement is made.

The transformers are Y-connected on the low side for 4,000-volt, three-wire distribution. The oil company's low-voltage bus is housed in a corrugated-iron building where meters, relays and low-voltage circuit breakers are housed as well. The power company furnishes a totalizing watt-hour meter and demand meter, which are checked by similar instruments owned by the oil company. A feeder switchboard consists of five panels for 4,000-volt feeders for power and three 4,000-volt feeders for lighting. An arrangement effective Aug. 1, 1927, makes it no longer necessary to meter the lighting and power separately and the separate lighting feeders are now unnecessary. Each feeder has a watt-hour meter and an ammeter and is provided with an oil circuit breaker with overload protection.

The 4,000-volt feeders consist of three No. 2/0 weatherproof wires radiating from the main substation to various parts of the oil field. Laterals are run from the main feeders to step-down transformer banks for supplying the pump motors. These transformer banks usually consist of three 50-kva. transformers centrally located with respect to six wells. Three-phase, 440-volt feeders radiate from the transformer banks, which in turn are tapped to serve the individual wells. Main secondary feeders consist of three No. 1/0 weatherproof wires, and for branches to individual wells No. 2 wire is used.



DIRECT GEAR-DRIVEN MUD PUMP FOR OIL WELL DRILLING USING A 15-35-HP. MOTOR. GENERAL PETROLEUM COMPANY

Generator Inspections

By O. M. Ward

Assistant Electrical Engineer Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

INSPECTIONS on all generators, motor-generators, rotary converters and exciters in the system of the Milwaukee Electric Railway & Light Company are specified and noted on the report here reproduced. Inspections are made on direct-current machines at intervals of two months and on alternating-current machines at six-month intervals. This information regarding machines, inspection periods, and the following quoted notes, are printed on the back of the form, which is a mimeographed sheet measuring 8½x5½ in.:

By "air gap, right" is meant the right-hand side of the unit when looking toward the machine from the end that gives clockwise rotation.

Ground tests on direct-current machines will be made with a voltmeter and the number of the meter, the meter reading and the voltage at which the test is made must be given. This test will include the armature, field and cables, unless otherwise stated.

Ground tests on alternating-current machines will be made with a megger.

Reverse-current relay tests will be made by reversing the machine and noting at what current the relay operates.

Overspeed tests are to be made only on all-electric machines. The series field must be cut out before driving a generator as a motor for the purpose of overspeeding.

MACHINE INSPECTION

Station .....Machine No.....Date.....

D.C. Shunt Field Connections.....

A.C. Field Connection .....

Series Field and Main Connections.....

Damper Winding .....

Gen. Air Gap. Top.....Bottom.....Right.....Left.....

Motor Air Gap. Top.....Bottom.....Right.....Left.....

A.C. Rings .....

Commutator .....

No. of A.C. Brushes changed incl. those changed since last inspection .....

No. of D.C. Brushes changed incl. those changed since last inspection .....

Brush Spacing .....

Condition of bearings if inspected.....

Was Bearing Oil Changed?.....

Ground Test on D.C. Gen.....

Ground Test on A.C. Gen. Armature.....Field.....

Ground Test on Motor Armature.....Field.....

Reverse current relay.....

Overspeed trip .....

A.C. and D.C. Riser Connections.....

Remarks:

Inspector.

Quality Industrial Lighting*

Field research in many industrial plants shows factors of illumination intimately related to production. Results establish standards for practical use

By Arthur A. Brainerd

The Philadelphia Electric Company, Philadelphia, Pa.

DURING the past few years many experiments have been made both in the laboratory and in the field to determine the exact effect of lighting on manufacturing operations. As a result of these tests, backed by such pertinent statistics as were available, the following advantages have been claimed for scientific artificial illumination:

1. Increased production.
2. Decreased labor turnover.
3. Decreased accidents.
4. Decreased spoilage.
5. Improved morale.

A study of these items will show that to assign accurate numerical values to statements 2, 3 and 5 is a very difficult task, involving the study of records covering a period of several years. Items 1 and 4, however, are comparatively easy to determine within a very short space of time if the operation is repetitive and if it is necessary to rely upon artificial illumination to any great extent.

Essentials of a Good Lighting System

A study of previous investigations of the effect of light on manufacturing operations revealed the fact that a majority of the cases studied dealt with purely hand operations, where operators were on a day-rate basis. In many cases the change was ascribed entirely to the change in intensity of illumination, although several other variables had been introduced, such as change in color and elimination of direct and reflected glare and sharp shadows.

Secondly, a careful investigation shows that for the Philadelphia area at least 76 per cent of the industrial work is done on semi-automatic or automatic machines and only 5 to 45 per cent of the time is spent on hand operations.

A consideration of these facts seemed to indicate that much remained to be done to place our present knowledge of illumination in such form that it will be readily understood and appreciated by the industrial executive.

In designing an industrial lighting system the following factors should be taken into consideration:

1. Intensity of illumination.
2. Uniformity of illumination.
3. Character and direction of shadows.
4. Character and direction of reflections.
5. Color of light source.
6. Maintenance and extensions.
7. Initial and operating cost.

The intensity of illumination to be used depends upon the visual angle, the reflection factor of the surfaces viewed, contrast in reflecting properties between material viewed and background, the value of product as related to floor area, percentage of window area, intensity and direction of natural light and the speed at which objects are moving.

In many lighting installations the results are unsatisfactory because of excessive variation in light intensity within the working areas and not because of insufficient intensity. Almost any operation can be lighted so that the variation factor within the working area shall not exceed 1.5. In many lighting installations today this factor has a value of 5 or over.

Since in most industrial establishments the surrounding conditions are such that it is impracticable to produce shadowless illumination, care must be taken to see that the shadows fall in such a direction as to do the least damage.

The same care must be taken in dealing with conditions where polished surfaces (such as a lathe chuck or face plate) normally come in the field of vision. Under such conditions the light should come from such a direction as to throw the direct reflection away from the worker's eyes.

In certain operations such as sorting cigars, inspecting cloth, coffee roasting, mixing paints, etc., it is absolutely necessary that light of the correct color value be provided. It goes without saying that as far as possible standard equipment that can be easily duplicated for extensions or replacement should be used. The equipment should be rugged in construction and easily cleaned.

It has generally been assumed that in order to satisfy these conditions direct lighting by means of metal reflectors is the only practical system to be considered in manufacturing operations, this being the best combination of low first cost, high efficiency and ease of maintenance. As a matter of fact, if the expenditure for equipment be considered on a cost basis, it will be seen that the fixed charges on lighting equipment will seldom exceed 10 per cent of the total operating costs, so that if more satisfactory illumination can be secured by the use of more expensive equipment it should be used. The fact that this idea can be sold is well illustrated by one case where a plant manager replaced bare drop lights with fixtures costing $20 apiece and was perfectly satisfied with the result.

Although the RLM dome and the "Glassteel" diffuser will undoubtedly satisfy 70 to 80 per cent of the lighting requirements in factories, all types of illumination can be used to advantage in some of the remaining 20 to 30 per cent.

**Abstracted from a paper by the author entitled "Quality Measurements in Industrial Lighting Calculations," which received the James H. McGraw N.E.L.A. award for merit.*

With the idea of studying these phenomena under commercial conditions, thirteen plants were selected where adequate records were available and arrangements could be made to carry on investigations that were sufficiently comprehensive. The real object of these tests was to secure data that would enable us to place industrial lighting recommendations on a more exact basis than is the present rule.

The numerical results of these tests are given in the accompanying tabulations, which include all the observed and derived data obtained for the several factors considered in this connection.

The general plan has been to study one machine or a group of machines and one or two operators. Where the regular factory records were sufficiently accurate and complete, these were relied on. In other cases a trained observer secured all necessary records. In investigations of this nature it is unavoidable that variables other than illumination creep in. These variables include such items as outside influence affecting physical ability, lack of uniformity of raw material, variation in distance of eyes from work, consciousness of close supervision, prejudice against any sort of change, influence of union officials, etc.

Another item that has an important bearing on the subject is handwork that mainly involved manual skill. In many cases only careful analysis by the aid of slow motion pictures would enable one to determine the actual percentage of handwork that involves seeing.

Since most of the operations studied were on automatic or semi-automatic machines, it became necessary to develop some formula for the variation in speed of handwork. In any mechanical process, if the machine runs at constant speed, it is obvious that while the machine is running the output is uniform. Theoretically

Table I—Effect of old and new illuminati

	Name and Address	Business	Operation	Per Cent Hand-work	Floor Area, Sq.Ft.	Surface		Refl. *K* Walls	Refl. *K* Work	Refl. *K* Back-ground	Per Cent Con-trast	Vi... Ar...
						Work	Back-ground					
1.	Reid Hosiery Trenton and Sargent Sts.	Hosiery mfg.	Knitting	6.7	136	Matte	Spec.	0.598	0.292	0.107	36.6	5.0
2.	Phila. Sweater Mills, Inc. 719 Arch St.	Necktie mfg.	Knitting	28.0	130	Semi-matte	Spec.	0.455	0.451	0.037	8.2	0.4
3.	Realart Silk Hosiery 6016 Palmetto St. (day)	Hosiery mfg.	Knitting	27.2	175	Semi-matte	Spec.	0.440	0.240	0.080	33.0	0.3
4.	Realart Silk Hosiery 6016 Palmetto St. (night)	Hosiery mfg.	Knitting	26.9	175	Semi-matte	Spec.	0.440	0.240	0.080	33.0	0.3
5.	Taylor Brothers Ambler and Adams Sts.	Cotton dress goods	Loom	.....	100	Matte	Matte	0.600	.....	.....	.....	1.5
6.	M. J. Smith Belting Co. Wayne Ave. and Berkley (night)	Belting mfg.	Loom	20.1	720	Matte	Matte	0.320	0.735	0.304	41.3	2.2
7.	M. J. Smith Belting Co. Wayne Ave. and Berkley	Belting mfg.	Loom	20.1	720	.....	.....	.....	.....	.....	.....	...
8.	M. J. Smith Belting Co. Wayne Ave. and Berkley	Belting mfg.	Loom	20.1	720	.....	.....	.....	.....	.....	.....	...
9.	M. J. Smith Belting Co. Wayne Ave. and Berkley (day)	Belting mfg.	Loom	20.1	720	.....	.....	.....	.....	.....	.....	...
10.	M. J. Smith Belting Co. Wayne Ave. and Berkley	Belting mfg.	Loom	20.1	720	.....	.....	.....	.....	.....	.....	...
11.	M. J. Smith Belting Co. Wayne Ave. and Berkley	Belting mfg.	Loom	20.1	720	.....	.....	.....	.....	.....	.....	...
12.	Shenn Mfg. Co. 314 Arnot St.	Towel and wash rag mfg.	Loom	22.6	286	Matte	Matte	0.400	0.500	0.140	28.0	1.2
13.	John Sidebotham 4317 Griscom St.	Tape mfg.	Loom	30.5	640	Matte	Semi-matte	0.742	0.430	0.154	36	0.9
14.	John Sidebotham 4317 Griscom St.	Tape mfg.	Loom	30.5	640	.....	.....	.....	.....	.....	.....	...
15.	American Pile Fabric Co. Adams Ave. and Wingohocking	Plush mfg.	Inspec.	100	75	Semi-matte	Semi-matte	0.474	0.191	0.191	.....	1.0
16.	D. B. Flower 1317 Spring Garden St.	Brass machine shop	Machine shop	100	80	Spec.	Spec.	.....	.....	.....	Above 40	...
17.	American Metal Works Stenton and Rockland Sts.	Radio and electrical goods	Turret lathes	37.2	50	Spec.	Spec.	.....	.....	.....	Above 40	...
18.	American Metal Works Stenton and Rockland Sts.	Radio and electrical goods	Turret lathes	37.2	50	.....	.....	.....	.....	.....	.....	...
19.	American Metal Works Stenton and Rockland Sts.	Radio and electrical goods	Turret lathes	37.2	50	.....	.....	.....	.....	.....	.....	...
20.	Decorative Lamp & Shade Co. 307 N. 8th St. (wood shop)	Lamp and shade mfg.	Wood-working shop	100	1,430	Matte	Spec.	0.259	0.383	0.139	36.3	1
21.	Decorative Lamp & Shade Co. 307 N. 8th St. (metal shop)	Lamp and shade mfg.	Metal shop	100	2,850	Spec.	Spec.	0.295	0.294	0.070	23.6	1
22.	B. Wilmsen 2444 Jasper St.	Xmas tree ornaments	Wire drawing	44.8	2,898	Spec.	Spec.	0.250	0.021	0.019	56.5	2.0
23.	Martell Mills Chester, Pa.	Cotton spinning	Splicing	66.6	500	Matte	Semi-matte	0.567	0.663	0.014	7.1	2.1
24.	American Pile Fabric Co. Adams Ave. and Wingohocking	Plush mfg.	Loom	.....	.....	Matte	Matte	0.427	0.587	0.001	0.17	1.0

* H.H. = Hanging height.

this would be true if the operation were carried on in total darkness, and the only improvement that better illumination could produce would be to speed up adjustments when the machine is not running.

Let M_1 represent the percentage of time during which the machine is running and m_1 the percentage of time spent in hand adjustments with the machine stopped. It is quite evident then that M_1K is equivalent to the amount of handwork completed and m_1k is equal to the time spent in doing this work, where K and k are constants depending upon the nature of the task. If we take speed as the reciprocal of time, it is evident that $\frac{M_1}{m_1} K =$ the speed of handwork where K is a constant.

If by the use of better illumination we succeed in reducing the percentage of time spent in making hand adjustments so that the ratio now becomes $\frac{M_2}{m_2} K$, it is evident that:

$$100 \times \left(\frac{\frac{M_2}{m_2} K - \frac{M_1}{m_1} K}{\frac{M_1}{m_1} K} \right) = \left(\frac{M_2 m_1}{M_1 m_2} - 1 \right) \times 100 =$$

per cent increase in speed of handwork.

For example, suppose that a loom is operating 80 per cent of the time, the remainder being spent in hand adjustments, and by means of good illumination this percentage is increased to 85. Then the increase in speed of handwork would be:

$$\left(\frac{85 \times 20}{80 \times 15} - 1 \right) \times 100 = 41.5 \text{ per cent.}$$

ystems on factory production and labor turnover

Old System					Daylight				New System				Per Cent Increase in Production		Wages		No. of Operators	Additional Lighting Cost Per Cent Payroll	Weekly Payroll Dollars per Sq.Ft. of Floor Area	Additional Lighting Cost per Week Dollars per Sq.Ft. Floor
Description	Av. F.C.	Var. Fac.	Var. Range	Shadows	Av. F.C.	Var. Fac.	Var. Range	Shadows	Description	Av. F.C.	Var. Fac.	Var. Range	Overall	Handwork	Dollars per Week	Basis				
re 100 w.	6.2	1.5	4.2	Dense	.....	Negl	igible	.....	R.L.M. 200 w. 9 ft. H.H.	17	1.4	2.0	6.3	155	22	Day	6	0.76	0.972	0.0074
re 50 and 00 w.	4.5	3.0	5.0	Dense		Negl	igible		R.L.M. 200 w. 8 ft. H.H.	17.2	1.6	2.5	10.8	43.7	25	Day	8	7.45	1.54	0.115
allow 100 w. ft. H.H.	.....	1.6	.....	Medium	8.8	1.6	3.3	Medium	R.L.M. 200 w. 8 ft. H.H.	17.3	1.4	1.7	3.9	15.7	75	Piece	2	0.36	0.857	0.00309
allow 100 w. ft. H.H.	7.2	2.2	.....	Dense	.....	.....	.....	.....	R.L.M. 200 w. 8 ft. H.H.	17.3	1.4	1.7	5.75	25.5	60	Piece	2	0.45	0.086	0.00309
ne 50 w., ft. H.H.	1.8	1.4	2.5	Dense	.....	.....	.....	.....	R.L.M. 75 w., 8 ft. H.H.	8.8	1.1	2.2	25	.....	16	Piece	1	1.4	0.160	0.00224
t tin 50 w., ft. H.H.	1.9	1.8	4.4	Dense	.....	.....	.....	.....	R.L.M., 75 w., 9.5 ft. H.H.	3.7	1.35	2.78	1.85	10	40	Piece	2	1.865	0.111	0.00095
									R.L.M. 100 w., 9.5 ft. H.H.	4.74	1.47	3.5	2.18	11.6	.....	.....	2	1.15	0.111	0.00127
									R.L.M. 150 w., 9.5 ft. H.H.	9.66	1.34	1.71	3.22	18.5	.....	.....	2	1.73	0.111	0.0019
									R.L.M. 75 w., 9.5 ft. H.H.	3.7	1.35	1.97	13.95	157.5	.....	.....	2	1.55	0.150	0.00233
									R.L.M. 100 w., 9.5 ft. H.H.	4.74	1.47	3.5	16.75	250	.....	.....	2	1.07	0.150	0.00155
									R.L.M. 150 w., 9.5 ft. H.H.	9.60	1.24	1.71	19.8	460	.....	.....	2	0.78	0.150	0.00117
ne 75 w., ft. H.H.	3.3	6.1	100	Dense	1.2	4.6	39	Dense	R.L.M. 75 w., 8 ft. H.H.	10	1.1	1.2	16	150	20	Piece	4	13.6	0.070	0.0952
re 75 w., ft. H.H.	6.8	1.5	2.9	Dense	.....	.....	.....	Dense	Indirect 200 w., 7 ft. H.H.	7.9	1.1	1.7	7.7	30.9	25	Piece	4	3.1	0.156	0.005
									Indirect 300 w., 7 ft. H.H.	15.5	1.1	1.7	11.1	48	.....	.....	.....	4.3	.....	0.00671
L.M. C2, lear 100 w., ft. H. H.	43	1.2	1.7	None	3.0	1.7	5.0	Negligible	R.L.M. C2 Frosted, 150 w. 5 ft. H H.	55	1.4	1.8	42	42	2'	Piece	5	0.97	1.40	0.0136
re 50 w., ft. H.H.	3.4	1.8	12	Dense	.....	.....	.....	Dense	R.L.M. 100 w., 8 ft. H.H.	8.7	1.4	3.7	3	3	40	Day	1	0.80	0.500	0.004
eep bowl 50 w., 6 ft. H.H.	11.6	1.94	7.5	Dense	2.5	1.2	1.3	Dense	R.L.M. 200 w., 8 ft. H.H.	20	1.3	2.1	12.35	42	31.50	Piece	1	1.71	0.63	0.0108
									R.L.M. 150 w., 9 ft. H.H.	14	1.3	1.8	6.73	20	.....	.....	.....	1.13	.....	0.0071
									R.L.M. 100 w., 9 ft. H.H.	7.4	1.2	1.6	2.25	6.2	.....	.....	.....	0.625	.....	0.004
re 50 w., ft. H.H.	4.5	2.1	1.4	Dense	4.5	1.1	5.0	Dense	R.L.M. 200 w., 9 ft. H.H.	25	1.4	3.5	20.9	20.9	25	Day	6	0.720	0.105	0.00075
re 50 w., ft. H.H.	3.3	2.1	1.4	Dense	2.0	3.5	14 0	Dense	R.L.M. 200 w., 9 ft. H.H.	15	1.5	3.1	18.1	18.1	.....	.....	9	1.23	0.0787	0.00096
ne 50 w., 5 ft. H.H.	2.9	1.9	4.3	Dense	29.6	2.0	15.0	Dense	R.L.M. 75 w., 9 ft. H.H.	9.2	1.2	1.4	16.5	46	.....	Piece	12	1.13	0.0871	0.00098
allow 75 w., ft. H.H.	4.7	2.3	7.5	Dense	6.6	2.1	10	Dense	R.L.M. 200 w., 10 ft. H.H.	27.5	1.3	1.7	7.8	12	21	Piece	8	0.22	0.272	0.000605
ne 50 w., ft. H.H.	10	1.6	2.9	Medium	2.0	1.5	3.0	Negligible	R.L.M. 75 w., 5 ft. H.H.	13	0	0	15	.....	40	Piece	.....	.....	.....	.....

From this equation it is quite evident that where a large percentage of the operation is automatic, it is necessary to bring about a very large increase in speed of handwork if we are to show any appreciable net increase in production.

Discussion of Results

Shadows and Production.—A careful study of cases 13 and 14 (the Sidebotham mills, see Table I) will show that a mere raising of average intensity of illumination had very little direct effect in improving production. In fact some preliminary figures taken at this plant seemed to indicate, notably in the case of the "Glassteel" diffuser, that increasing intensity served merely to make the shadows harsher. The following records will give some idea of the close relation between production and shadows:

System	Average Foot-Candles	Variation Factor	Production Increase, Per Cent
Bare drop	6.78	1.48	0
Glassteel	19.8 (harsh shadows)	3.85	Negligible
RLM	12.32	1.46	3.85
Indirect	7.9	1.09	7.70
Indirect	12	1.09	11.00

These results are confirmed by the following figures taken from cases 17, 18 and 19 (the American Metal Works):

System	Average Foot-Candles	Variation Factor	Production Increase, Per Cent
Deep bowl reflector with bare lamps	11.6	1.94	0
RLM (BE lamps)	7.4	1.21	2.25
RLM (BE lamps)	14	1.3	6.73
RLM (BE lamps)	20	1.3	12.35

In both cases it will be noted that production was increased by reducing shadows, even when the foot-candle intensity was lowered. After objectionable shadows had been eliminated production increases were consistent.

These results are further confirmed by those at the Martell mills. Here variation factor was reduced only from 2.3 to an average of 1.3 and the variation range from 7.5 to 1.7. A production increase of 7.8 per cent was then noted. After this change had been made no consistent difference in speed of work was noted at several illumination levels varying from 7 to 40. This was also true in case 6 (the M. J. Smith Belting Company), where variation factor was reduced from 1.8 to 1.35, and case 5, where the variation factor was reduced from 1.4 to 1.1.

In cases 3 and 4 (the Realart Silk Hosiery Company) the variation factor was reduced from 1.6 to 1.4 in the daytime and from 2.2 to 1.4 at night. The fact that production could be increased 3.9 per cent in broad daylight where the natural illumination was excellent and the only function of artificial lighting was to dispel the shadow of operator, caused by the vertical windows, demonstrates conclusively the important relation that exists between shadows and production. The higher percentage of increase on the night shift, when the shadows are more dense than in the daytime, also serves to illustrate this point.

A study of the tabulated records shows that in practically every case the change to a modern system of illumination involved a substantial decrease in variation factor, all of which goes to show that proper distribution and diffusion of light are of fully as great importance in production operations as mere light intensity, if not of greater importance.

Direction and Character of Reflections.—We frequently hear the statement made that in case of doubt a uniform system of 200-watt RLM's on 10-ft. centers is good illumination. One of the objects of this series of tests was to find sales arguments that would enable us to convince officials of machine tool shops that their lighting problems could best be solved by means of fixed overhead units instead of adjustable drop lights. Experiments in this direction were commenced in the plant of the Progressive Foundry & Machine Company.

Since this shop was engaged in experimental work, it was not possible to get any exact figures on production. Careful tests conducted with an experienced machinist showed that 20 to 25 foot-candles of well-diffused light was necessary to read a micrometer and set a tool to the best advantage.

In order to throw the reflected images of the lighting unit away from the operator, the best position of the unit was fixed at 8 ft. above the floor directly over the operator's right shoulder. A 150-watt bowl enameled lamp in an RLM dome gives excellent results when the lamp is new and the reflector is clean. This method was tried in several jobbing machine shops with lathes, millers and shapers. In the case of small planers, the unit was mounted directly above the bed.

In order to verify the correctness of these deductions two tests were later conducted, one on a drill press at the plant of D. W. Flower and the other on a turret lathe at the plant of the American Metal Works. The factory records for the drill press showed a production increase of 3 per cent, although the foot-candle intensity was increased only from 3.4 to 8.7. Due to lack of uniformity of tasks performed there was no opportunity to check the figures.

The test on the turret lathe was conducted under more favorable conditions and the results were even more significant. When the glare conditions were corrected and shadows reduced and directed in such a manner as to do the least harm, the production was increased 2.25 per cent, although the foot-candle intensity was actually reduced from 11.1 to 7.7. When the proper distribution of light had been secured, raising the foot-candle intensity to 20 increased the production 12.35 per cent above what it was under the old conditions.

Our experience in various industries has convinced us that in a very large percentage of plants each machine or group of machines or operations should be considered as a unit by itself and be lighted by fixed units of relatively high power. This makes it possible to give the proper consideration to reflections, also high-intensity light can be concentrated in the working area. A fixed unit is in most cases preferable to an adjustable unit, since experience shows that rarely does an operator possess the ability to keep an adjustable unit in the correct position. It is much better to find the best all-around position for lighting unit and keep it there than to allow every operator to adjust the lights. We cannot expect a machinist to be an illuminating engineer.

Character and Reflection Factor of Surfaces in the Field of Vision.—Closely allied to the foregoing items is the question of contrast in reflection factor between the work and the background. It is of course self-evident that black on gray cannot be seen as easily under a given condition of illumination as black on a white background. A much higher intensity is necessary to secure the same degree of visibility in the former case. It is to be expected therefore that these tests would show

Table II—Illumination Details of Fourteen Factories Studied

Name	Present Illumination		Variation Factor	Shadows	Reflection	Background Contrast	Visual Angle in Minutes	Natural Illumination	Calculated	Actual	Per Cent Error
	Excellent		0 to 2.2 0	Negligible 0	Diffuse 0	Below 10 0	Over 3 0	Excellent			
	Fair		2.2 to 3 5	Medium 2.5	Specular 5	10 to 40 5	1.1 to 3 2.5	Fair 5			
	Bad		Over 3 10	Dense 5	Glare 10	Above 40 10	0 to 1.1 5	Bad 10			
Philadelphia Sweater	Bad	Excellent	10	5	5	0	8	10	38	43.7	—13
Realart Hosiery (3)	Fair	Excellent	0	2.5	5	2.5	4	2.5	16.5	15.7	+ 5.1
Realart Hosiery (4)	Fair	Excellent	0	7.5	5	2.0	4	5	24	25.5	— 5.88
M. J. Smith (6)	Bad	Bad	0	7.5	0	0	0	0	7.5	10	—25
M. J. Smith (7)	Bad	Fair	0	7.5	0	5	2	5	19.5	11.6	+68
M. J. Smith (8)	Bad	Excellent	0	7.5	0	10	4	10	31.5	18.5	+70.3
John Sidebotham (13)	Bad	Fair	0	7.5	0	5	4	5	21.5	30.9	—30.4
John Sidebotham (14)	Bad	Excellent	0	7.5	0	10	8	10	35.5	43	—17.4
American Metal (18)	Bad	Bad	0	7.5	0	0	0	0	7.5	6.2	+21
American Metal (19)	Bad	Fair	0	7.5	5	5	0	5	22.5	20.2	+11.5
American Metal (20)	Bad	Excellent	0	7.5	10	10	0	10	37.5	42	—10.7
Decorative Lamp, wood	Bad	Fair	5	5	2.5	5	4	5	26.5	20.09	+31.9
Decorative Lamp, metal	Bad	Fair	5	5	0	2.5	4	5	21.5	18	+19.4
B. Wilmsen	Bad	Excellent	0	7.5	10	10	4	0	31.5	46	—31.5
								Average error, per cent			+ 6.66

some indication of the practical importance of this particular item. Referring to Table I, we see that all the seven cases where the background contrast was more than 35 per cent (Nos. 1, 6-11, 13-14, 16, 17-19, 20 and 22) showed increases in speed of handwork of 20 per cent or over (contrast as used here is minimum reflection factor divided by the maximum). These figures prove beyond a shadow of doubt that background contrast has an influence on the character of the lighting system required and must be considered in laying out any system of productive illumination.

Dr. Ferree and Dr. Rand in a paper read before the 1926 convention of the Illuminating Engineering Society showed that the illumination intensity necessary to secure maximum speed of vision varies widely with the difference in brightness between the object viewed and the background. The highest contrast values used in their tests correspond to a value of 25 per cent as recorded in this paper. But even at this value and with a visual angle of one minute, it was necessary to employ an intensity of 68 foot-candles before the speed of vision curve began to flatten out.

The practical value of this phase of the problem was especially noticeable in two cases, although no extensive tests were conducted. One was in case 13, where a piece of black oilcloth used as a background for white yarn greatly lightened the task of perceiving broken ends. The other was in the case of a surface grinder in a linotype factory. Here the operator fastened a piece of white paper as a background for his grinding wheel. Improvement in the quantity and quality of his work was noted.

Visual Angle and Illumination.—Visual angle has always been recognized as having an important bearing on the character of illumination. The following figures are taken from five different textile mills where the handwork is similar in character:

Location	Visual Angle, Minimum	—Foot-Candles— Old	New	Per Cent Increase in Speed of Handwork
Realart	0.552	7.2	17.3	25.8
Sidebotham	0.942	6.8	15.5	48
Shenn Mfg.	1.21	3.3	10	150
Smith, M. J.	2.2	1.9	9.7	18.5
Reid	5.83	6.2	17	370

In each of these cases the illumination was very bad. A glance at the figures will show that for angles of 0.5 minute and above there is no reason to believe that illumination will speed up production more with a small visual angle than with a large angle. Of course these results cannot be taken as meaning that visual angle has no bearing on the behavior of a lighting system, but rather that visual angle is by no means the deciding factor.

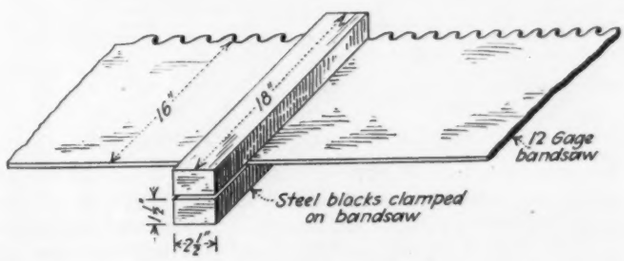
Dr. Ferree and Dr. Rand in the paper referred to have also shown that higher intensities of illumination are absolutely necessary as the visual angle decreases, if we are to maintain the same speed of vision.

In attempting to reconcile these results with practice, however, we find that since the visual angle varies so widely every time the worker moves his head, it is almost impossible to strike a fair average by any method developed up to the present time. This will partly account for some of the discrepancy between the results of this investigation and the findings of Dr. Ferree.

The second part of Mr. Brainerd's paper, giving illustrative examples of practical applications in quality industrial lighting, will appear in an early issue of ELECTRICAL WORLD.

Reducing Sawmill Fire Hazard

REDUCED fire hazard, absence of scale, cleanliness and greater uniformity of welds are factors that are leading sawmills of the Pacific Northwest to use electric muffle furnaces in the saw-filing shop for annealing silver-soldered joints in band saws. The usual practice is to replace the small blacksmith's forge with a standard 7½-kw., 220-volt, non-automatic muffle furnace for heating the annealing blocks. After a band saw has been mended with silver solder the steel-annealing blocks, which have been heated to a temperature of 1,600 deg.



METHOD OF APPLYING ELECTRICALLY HEATED STEEL BLOCKS TO HEAT TREATING OF BAND SAW JOINTS

C. in the furnace, are clamped onto the saw and allowed to remain for about 30 minutes while cooling and completing the heat-treating process. About 1½ hours of pre-heating of the blocks in the furnace is required to raise them to a uniform temperature of 1,600 deg. C.

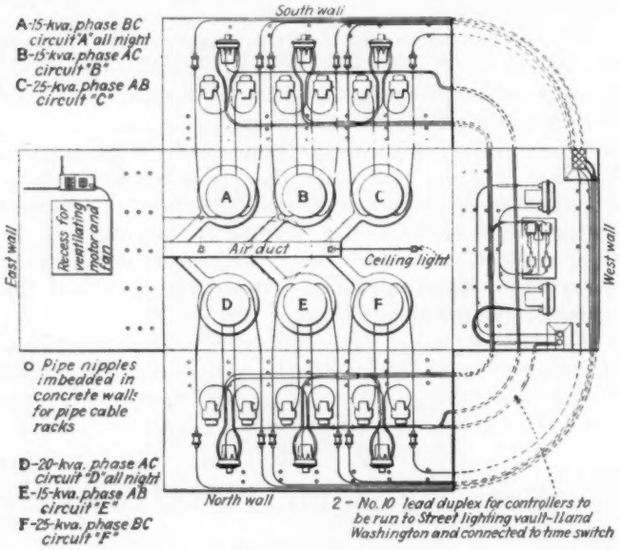
Energy consumption is of secondary importance when the advantages of the electric furnace are taken into consideration.

Cable Layout Aids Splicers

By T. W. Swartz

Assistant Engineer Underground Department, Northwestern Electric Company, Portland, Ore.

FURNISHING cable splicers with a cable layout, such as that shown in the accompanying diagram for a transformer vault, has been found by the Northwestern Electric Company, Portland, Ore., to result in a much neater, safer and more economical job. As will be seen from the diagram the four walls and floor of the vault are laid out in the same plane. This gives the splicers a picture of what the cable layout should look like when the vault is completely wired and enables them to go about their work in an orderly and efficient manner.


South wall
A-15-kva. phase BC circuit "A" all night
B-15-kva. phase AC circuit "B"
C-25-kva. phase AB circuit "C"
Recess for ventilating motor and fan
East wall
A
B
C
Air duct
Ceiling light
West wall
D
E
F
o Pipe nipples imbedded in concrete walls for pipe cable racks
D-20-kva. phase AC circuit "D" all night
E-15-kva. phase AB circuit "E"
F-25-kva. phase BC circuit "F"
North wall
2 - No. 10 lead duplex for controllers to be run to Street lighting vault-11and Washington and connected to time switch

OFFICE PLANNING OF VAULT CABLE LAYOUT SAVES TIME AND AVOIDS CONFUSION IN THE FIELD

List of Material

Number	Description
2	25-kva. constant current transformers
1	20-kva. constant current transformer
3	15-kva. constant current transformers
2	400-amp. oil switches
12	50-amp. oil fuse cutouts
6	Subway controllers
12	Disconnecting potheads, 100 amp.
2	200-volt-amp. potential transformers
2	100-amp. current transformers
No. 2	Three-conductor, 2,400-volt lead cable
No. 2	One-conductor, 2,400-volt lead cable
No. 8	One-conductor, 5,000-volt lead cable
No. 10	Duplex lead control cable
1	24-in.x48-in.x12-in. instrument transformer box
1	12-in.x26-in.x6-in. metal box, vault-service
1	60-amp., three-pole S.T. switch-motor control
1	30-amp., three-pole S.T. switch
1	30-amp., two-pole fuse block for vault-lights

Formerly it was left to the cable foreman to work out his own vault cable plan in the field. This method has given way to the present plan, whereby careful engineering in the office in advance avoids lost time and confusion in the field. This plan has been followed for several years and is particularly advantageous for large and complicated vault layouts.

Restoring Service After Flood at Burlington

DURING the flood in the Winooski Valley of Vermont last November the water rose 27 ft. above the crest of the dam at the Gorge plant of the Burlington Light & Power Company, flowing over the roof of the old 1,500-kw. hydro station and submerging the condenser pump of the 2,500-kw. auxiliary steam plant, which was safely located on the west bank of the Winooski River. The 4,800-kw. station at Essex was flooded from the tailrace back-up to a depth of 20 ft. above the operating room floor. Essex was shut down at 4:30 a.m., Friday, Nov. 4, and as the Gorge hydro plant was also flooded it became necessary to concentrate energy first upon putting the auxiliary steam plant in service at the top of the Gorge. This steam plant had not been in operation for a month and the boilers were in winter quarters, as it were. The main boiler-feed pumps were under water in the old Gorge plant. By 1 p.m., Friday, the steam plant was put in service, running non-condensing and supplying a load of about 800 kw. to such important customers as the newspapers, bakeries, two hospitals and the U. S. Army post at Fort Ethan Allen. Feed water was obtained by a 3-in. connection with the Winooski municipal water system. On Saturday the water had run out of the Gorge hydro station sufficiently to permit operating the feed pumps and the load was increased to 1,200 kw. By Monday it was possible to operate condensing in time for supplying the power load. Material aid was given, through a tie line, by the Vergennes plant of the Peoples Hydro-Electric Vermont Corporation during the first week after the flood, and efforts were made to obtain help from the city steam plant at Burlington, but these were unsuccessful. The interconnection with the Fairfax plant of the Public Electric Light Company of St. Albans did not serve as the generators of the latter were wet and trouble occurred from coil burnouts.

Rehabilitation of hydro-electric supply was based upon the plan of putting an engineer and four expert wiremen at each station, with the added help of General Electric wiremen and winders on apparatus. The U.G.I. interests of Philadelphia sent engineers and wiremen to Burlington and the entire construction crew at work on the new 3,000-kw. Gorge hydro-electric development opposite the old Gorge station was turned over to the rehabilitation job. These men moved an 8-in., 50-hp. motor-driven condenser pump from the Gorge to Essex and installed this with two other pumps to help clear the station. The company's river crossing between the Gorge and Essex was washed out and a temporary line was shot across by the Burlington company's line department in co-operation with the New England Telephone & Telegraph Company's field forces and put in operation by Sunday evening.

Before power was obtained efforts were made to siphon out the water from the Essex station, using fire engines and sewer pumping outfits. The large motor-driven pumps rapidly lowered the water level, and on Sunday night it was all pumped out, leaving 2 ft. of mud on the floor under a great mass of lumber and refuse which the flood had carried in through the windows. Seventy men were put in the plant to carry out the refuse, shovel the mud into barrows and wheel it up runways to the windows overlooking the tailrace, whence it was ejected.

At the same time the apparatus was being washed out with water under pressure. Twelve salamanders were assembled by punching holes in transil oil drums, inserting a home-made grate of flat rods in each and mounting on non-combustible bases, coke being used as fuel. Six of these outfits were also built for the Gorge plant. Windows were boarded up, electric ovens built and the drying out process started. By Tuesday morning the floor at Essex was dry and two loads of sawdust were put down. One generator and one waterwheel-driven exciter were boxed in and external heat applied by using trolley car heaters, bathroom spot heaters, etc., and these machines were running on dry-out five days after the shut-down.

About 2 miles of 33-kv. and 13-kv. lines were down between Essex and Montpelier and this reconstruction was accomplished by a line crew and truck sent to Vermont by the Suburban Counties Company, despite great handicaps in highway communication. A truck with an exciter, oil drier, megger, transformers and tools was also sent to Burlington from the U.G.I. headquarters. This exciter made it possible to carry load at Essex fourteen days after the machines were submerged.

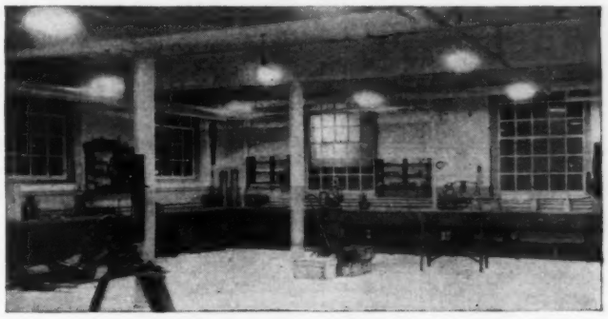
At the Gorge plant water poured in the upstream windows behind the switchboard, but due to the floor openings to the tailrace water did not stand very deep (about 2 ft.) on the floor and ran out as soon as the flood subsided. One generator at the Gorge hydro plant was put in service Nov. 13 and all machines were available Nov. 20 at Essex. The first machine went back into service on the same day. At both plants it was necessary completely to rewire all panels and to renew all non-lead-covered cable and control wire. A good feature at Essex in the original plant design was the use of lead-covered cable and potheads on the generator and exciter leads and of lead-covered wire for station lighting. It was possible to salvage most of the equipment, including 87 out of 90 instruments and meters.

Equipment that could not be salvaged on the job included potential transformers and the majority of current transformers, bellows type relays and some shunt field coils on exciters. One field winding on an Essex generator had to be reinsulated from the pole piece, and it is expected that next summer the other machine fields will have to be similarly treated.

Modern Lighting in a Service Building

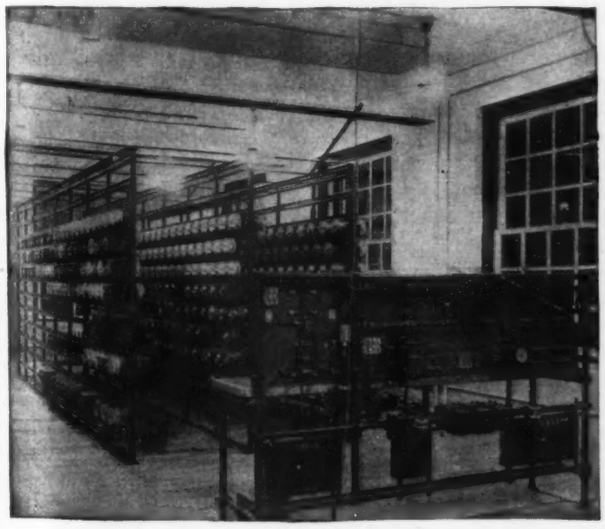
By Willard Allphin
Lighting Engineer
Fall River (Mass.) Electric Light Company

THE new service building of the Fall River Electric Light Company is equipped with lighting of the most approved type, not because of the advertising value of high intensity illumination, but because executives of the company are convinced that good lighting will pay dividends in safety and comfort for the workers, and in increased production. The illumination in any room is no more elaborate than could be conscientiously recommended to a customer for the same type of room.



DARK CORNERS AVOIDED IN REPAIR SHOP

The main office is lighted by 300-watt totally indirect fixtures of the luminous bowl type. These are mounted on 11x12-ft. centers and give an intensity of 12 foot-candles on the usual plane 30 in. above the floor. The drafting room is lighted to an intensity of 25 foot-candles by 500-watt totally indirect, opaque bowl fixtures, on 11-ft. centers. The distribution superintendent's office contains two 300-watt totally indirect units of the luminous bowl type, giving an intensity of 12 foot-candles. The other private offices differ only in being smaller and containing but one fixture. In the main section of the meter department, 200-watt RLM domes are used on 10x11-ft. centers, providing 10 foot-candles of light.



ILLUMINATION IN METER DEPARTMENT WAS DESIGNED FOR THE DETAIL WORK INVOLVED

WORK ON STREET-LIGHTING EQUIPMENT MADE EASIER BY ADEQUATE ILLUMINATION

High intensity lighting for fine repairs is provided by two 500-watt "Glassteel" diffusers which give an intensity of 30 foot-candles. Over the meter racks, 200-watt extensive type prismatic reflectors are used to obtain 8 foot-candles on the vertical surfaces of the meters. Illumination in the street lighting department, the underground department and all similar shops and workrooms is furnished by 200-watt RLM domes.

Bowl white lamps are used throughout in all RLM domes, and all direct reflectors are suspended on conduit with aligners at the outlet boxes. Mounting heights are consistent with the rule that the spacing shall not be more than one and one-half times the mounting height above the working plane. Duplex convenience outlets were installed liberally throughout the building.

Our janitor has been carefully instructed in the methods of cleaning the various types of fixtures and is required to sign a cleaning chart, ruled for months and rooms, each time he cleans the fixtures. The foreman in charge of the building sees that each square is signed every month.

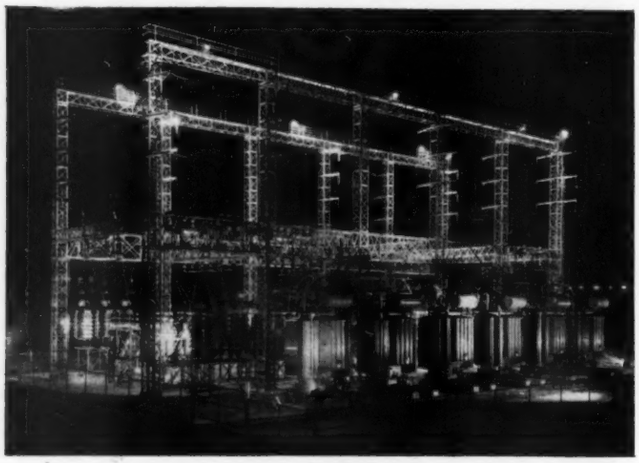
Although the lighting was put in entirely on its own merits, it has been found a valuable sales help in demonstrating office, drafting room and industrial lighting to customers. The cost of the lighting installation was 4 per cent of the total cost of the building.

Substation Has Publicity Value

By Stanley Stokes
Power Supervisor Union Electric Light & Power Company
St. Louis, Mo.

A CONSPICUOUSLY good example of bringing to the public consciousness at least one phase of the utility business is afforded by the Cahokia substation of the Union Electric Light & Power Company at East St. Louis, Ill. This station, which is an impressive structure by day, becomes more spectacularly interesting at night, when it looms up out of the darkness under well-designed and adequate illumination.

Nineteen floodlighting units are used, eleven 500-watt lamps being placed along the top of the structure and

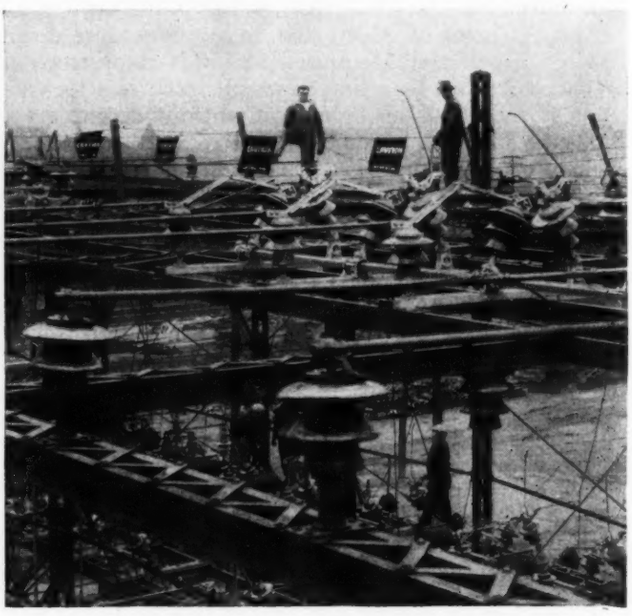


FLOODLIGHTS TRANSFORM SUBSTATION TO A CONSPICUOUS UTILITY ADVERTISEMENT

on the fence and eight 200-watt sources at a lower level. An energy consumption of 8.1 kw.-hr. per hour offers a strikingly vivid and convincing advertisement of electric service. Since the lighting is a necessary part of the station-operation equipment, its installation cost can be so charged, leaving the energy as the sole cost of the advertisement.

Safety for Outdoor Substations

PROTECTION for operating and maintenance men in outdoor substations is one phase of the safety work of the Utica Gas & Electric Company, Utica, N. Y. This activity is under the direction of N. E. Emmons, superintendent of maintenance. Red flags are suspended around roped-off areas in sections where work is being



SAFETY MAN ESTABLISHES WORKING ZONE

In this 44-kv. yard the flags on a rope fence mark working limits. The safety man who is always on every job of such a nature stands close to the column. Only the particular bay on which the men are working is dead. The boundary flags constitute the "dead line" on both the second and top elevation of the structure.

done in outdoor substations and it is the duty of the safety guard in charge to see that these boundaries are not overstepped. Insistence upon safety is the sole function of this man and his word is final. The only way in which his orders can be negated is by removing him from the job under orders of the superintendent of maintenance or general superintendent. The results of this plan have been highly satisfactory in reducing accidents.

This company also follows the somewhat unusual procedure of testing rubber gloves and protectors weekly. The expense of this work is, of course, greater than where the tests are not performed so frequently, but defective material is encountered upon every weekly test, indicating the value of such frequent checks.

All equipment is fully labeled in outdoor substations. Warning signs for company men, indication of duty of all equipment, line and phase notations and opened and closed positions of all operating levers are clearly marked. Phase designations are shown on each breaker tank as well as under the buses, thus minimizing errors in cutting in a new job. A red circle with an arrow is placed on the oil switch housing. There is also a red light in connection with this particular location. These are to draw attention to the emergency handle for the oil circuit breakers.

Protective Grounding

A discussion of the recommended practices of the National Electrical Manufacturers' Association

By S. W. BORDEN*

TO ESTABLISH uniform methods of construction and installation which will do away, in so far as possible, with electrical fire and shock hazards the National Electrical Manufacturers' Association has recently studied and approved certain practices for protective grounding. The recommended practices of the N.E.M.A. are given elsewhere on this page. The desirability of protective grounding is generally conceded, and the circuits installed for this purpose are often referred to as "safety circuits." The greatest single element of resistance in a safety circuit is usually the resistance to the flow of current away from the earth electrode into the surrounding earth. Urban and most suburban districts are equipped with general water-supply systems which, for the most part, constitute an adequate, economical and convenient earth electrode for electrical safety circuits. In rural and farming districts and in some industrial establishments where no such suitable earth electrode is available an artificial ground must be resorted to.

Fig. 1 is a schematic wiring diagram which is more or less characteristic of industrial-plant installations. The effectiveness of any system of protective grounding depends upon its ability to provide protection under both normal and abnormal conditions and to remain intact and in proper working order irrespective of such changes in the wiring system itself as are liable to take place in the normal course of operation. The most severe abnormal conditions are encountered when the higher voltage of a primary system, a series street-lighting system or a trolley feeder finds its way to the secondary wiring, or when a failure occurs in the insulation of a wire in a metal wire inclosure or in the insulation of some appliance or equipment which permits one of the conductors to come into contact with the metal inclosure. The more common changes in the wiring system which may be expected are the reversal of a pair of wires or the open-circuiting of a conductor either by the blowing of a fuse or otherwise.

When the safety circuit consists of the metal inclosure of the conductors there is little possibility of the safety circuit conductor and a working conductor being transposed. When a copper safety circuit is installed its use is obvious, and while electricians and laymen alike are accustomed to arranging two wires more or less indiscriminately, they are also accustomed to arranging three wires systematically since three-wire circuits must be so arranged to be operative. Safety-circuit conductors are clearly identified, as are the safety poles of plugs and receptacles, such poles being marked "Ground." It is suggested that "Safety" is a better marking, because "Ground" may be confused with "grounded wire."

Under normal conditions the neutral or white wire, which is connected directly to the water-piping system, is at earth potential. All of the metal work is likewise at earth potential. Between each of the other wires of the system and the earth there is a potential of 110 volts or more, and a person touching either of these wires, or anything in direct contact with these wires, is liable to receive a shock. There is no known method of effectively eliminating this latter hazard, but it may be reduced to a minimum by means of identified, polarized wiring.

Assume that a high potential from the primary system finds its way to the secondary system and a current flow of 50 amp. takes place. If the ground resistance is 2 ohms, then the grounded-circuit conductor will be raised to a potential above ground of 50 × 2, or 100 volts, and

*Mr. Borden is a member of the N.E.M.A. grounding committee, a member of the grounding committee of the International Association of Municipal Electricians and a member of the grounding committee of the New York Chapter of the Eastern Association of Electrical Inspectors, and he has devoted a great deal of his time to the study of the grounding problem.

Recommended Practices

1. Wiring systems should be grounded "where" and "as" required by the National Electrical Code.

2. Non-current-carrying exposed metal parts of fixed equipment, etc., in industrial domestic and other locations should be grounded, with exceptions under certain conditions. Such an allowable exception might be for outlet boxes, fixtures, etc., in rooms of frame dwellings where containing no metallic piping or fixtures connected thereto.

3(a). In industrial locations, except offices, public utility stations and for industrial usages which have certain conditions and are therefore exempted, non-current-carrying exposed metal parts of detachable (portable) equipment should be grounded.

Exempted, except in hazardous, extra-hazardous and conductive locations, are detachable appliances which are not operated above 150 volts and inherently are sufficiently safeguarded against probability of harmful leakage from their exposed metal parts to persons or objects by reason of either (1) their infrequency of handling, (2) their assured degree of insulation between live parts and exposed metal parts, or (3) their inherent characteristics, leading to improbability of exterior metal parts touching persons or objects in such a way as to harm them.

Examples (1) General purpose ventilating fans; (2) "approved" general-purpose pressing irons.

3(b). In office, utility and dwelling locations, and in all other locations except industrial ones, non-current-carrying exposed metal parts of detachable equipment should be grounded where operating at over 150 volts.

3(c). In office, utility and dwelling locations, and in all other locations except industrial ones, non-current-carrying exposed metal parts of detachable equipment, where operating at less than 150 volts, need not be grounded.

4. Conduit with fittings, armored cable sheath with fittings, metal raceway with fittings, and a safety grounding wire suitably identified as such and run with the system conductors, may be used as the grounding medium for equipment ground, or as a portion of such grounding medium, "where" and "as" provided for in the National Electrical Code.

5. No current-carrying conductor of an interior wiring system should be used as a grounding medium, or portion therefor, to ground fixed or detachable equipment.

the other conductors will have a potential above ground of 210 volts. The only way in which this rise of potential can be kept within safe limits is by keeping the resistance of the secondary ground circuit sufficiently low. However, where the N.E.M.A. grounding method is followed the equipment frames will remain at earth potential, unless a breakdown occurs in the insulation.

If the insulation on one of the ungrounded circuit wires becomes defective and the circuit wire comes into contact with a grounded metal inclosure, the result would be a short circuit, which would blow the fuses in the ungrounded conductor unless the resistance of the safety circuit provided was so high that the resulting current potential of 110 volts to earth and the third conductor would be at a potential of 220 volts to earth. This condition, however, would be quickly discovered, because there would now be 220 volts between the white conductor and one of the others where there should be only 110, and during the short time that the trouble existed the hazard would probably not be very serious because the frames of all the equipment would still be maintained at earth potential.

If for any reason whatever the grounded-circuit conductor becomes open-circuited at some point, the safety features of the system, in the way of equipment grounding, are in no way affected, no hazard is created, and

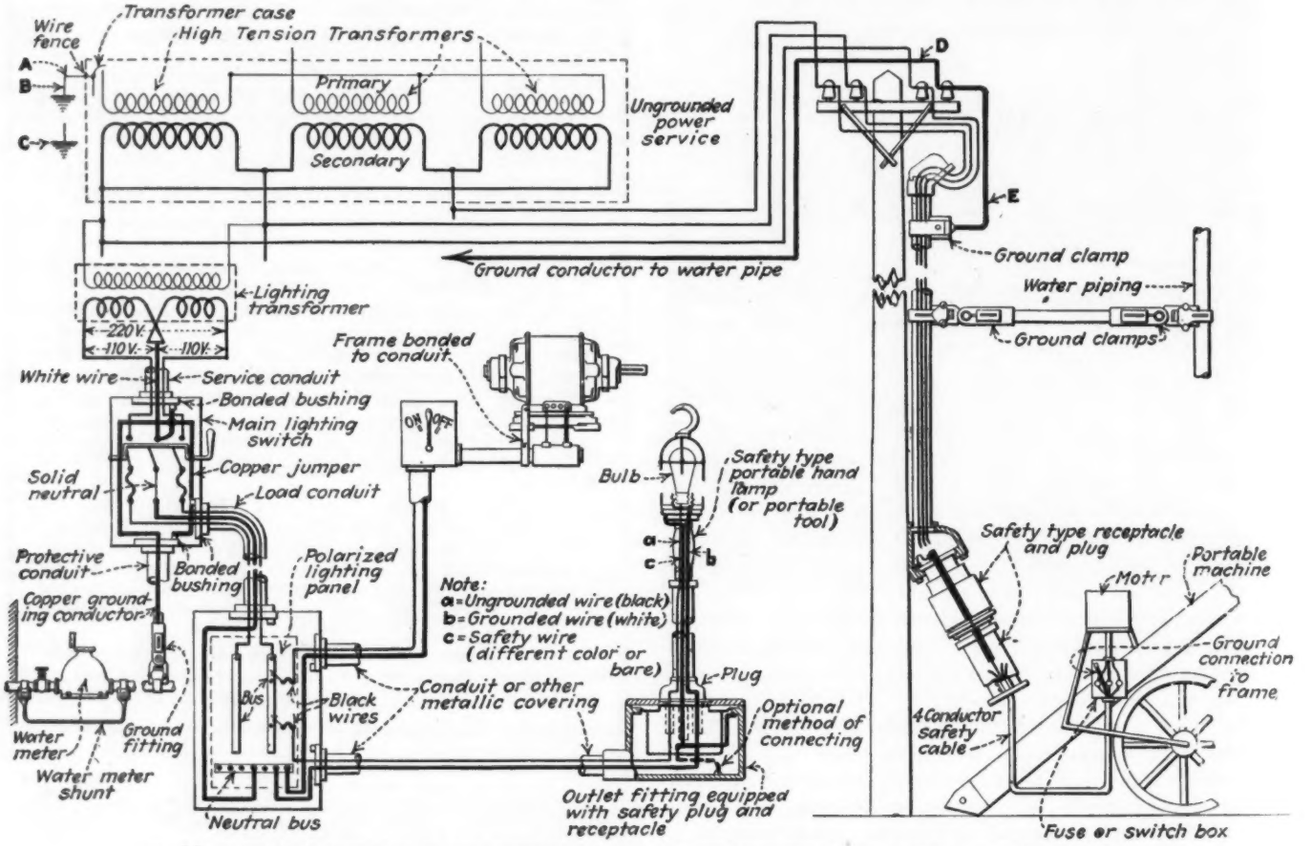


FIG. 1—TYPICAL INDUSTRIAL PLANT INSTALLATION IN ACCORDANCE WITH THE N.E.M.A. RECOMMENDATIONS
(For high-tension grounding see N.E.L.A. bulletin No. 256-20)

A. Transformer cases, switchgear, framework and wire fence to be grounded.

B. To street side of water meter or to independent artificial ground of not more than 3 ohms and not smaller than No. 6 B. & S. wire.

C. Lightning arrester must have independent artificial ground, which should be 20 ft. from equipment ground and preferably not more than 10 ohms.

D. If necessary to reach permanent cold-water-piping system, run ground conductor to another building.

E. Can be run inside the conduit and attached to safety terminal of receptacle.

was limited to an amount insufficient to blow the fuses. With any of the metallic inclosures which are recommended by the N.E.M.A. as suitable safety circuits this condition would not exist, except possibly in the case of an exceptionally long circuit of certain types. If the fuse should not blow, the metal inclosures will assume a potential above earth equal to that of the conductor with which it is in contact, which again emphasizes the fact that the effectiveness of a safety circuit is dependent upon its resistance.

If the grounded-neutral conductor and one of the other conductors of the system are inadvertently reversed, there would be no tendency to blow the fuse, but one of the conductors would be at the same potential as the earth, while the white identified wire would be at a the only effect is to injure or interrupt the service. If an open circuit occurs in a conductor of one of the safety circuits, the usefulness of the safety circuit would be destroyed, but there would be no additional hazard created.

All the above conditions have been predicated on the assumption that a water system is available for grounding. Where artificial grounds are employed, the conditions are as shown in Fig. 2 (a) and (b). The extent to which the secondary voltage would be raised above earth potential, with conditions such as exist in Fig. 2 (a), without an accidental ground, depends on a great many variable conditions, but it may be anything from nothing to practically the full voltage of the primary system. With an accidental ground, as at G_3, but without a high-tension

cross-connection, both wires of the system will have a potential above earth inversely proportional to the resistance of the respective ground circuits. With the circuit shown the maximum potential is limited to 110 volts, but in the case of industrial establishments, where the 110-volt lighting and appliance circuits are often taken from auto-transformers connected across 440-volt and 550-volt power circuits, and from multi-wire systems, it is possible to obtain the full voltage of those systems between the supposedly grounded conductor and the earth.

These conditions at first sight look rather serious, as they are, but, if grounded as in (a) Fig. 2, these dangerous potentials are confined to the conductors, and it is not very probable that any one will come into contact with the conductors during the usually short period when such conditions exist. So long as there is no breakdown in the insulation of the secondary system the metallic inclosures will remain at earth potential when they are connected to a separate and independent ground electrode as G_2. If grounded as in (b) the inclosures will have the same potential as the grounded circuit wire, for which reason the code specifies individual electrodes where artificial grounds are used.

It has been suggested that the metallic inclosures might be grounded by connecting them to the grounded-circuit wire, as in Fig. 2 (c) and (d). With this system full potential is placed upon the equipment frames in case of an open circuit, as in (c), or in case of a reversal as in (d), and it also has all of the disadvantages of system (b). Such a grounding system nullifies those sections of the code which prohibit grounding the circuit wire inside the main switch and the interconnection of neutrals, both of which requirements are important safety measures embodied in the code.

The thing we are most seriously concerned with just now is the grounding of portable equipment in industrial establishments, and considerable pressure is being brought upon these establishments by industrial boards, labor commissions and others to this end. As a matter of fact, none of the old wiring and very little of the modern wiring in industrial establishments is polarized, but, on the other hand, the circuits are generally double-fused and switched, which condition, of course, presents a constant possibility of the grounded circuit wire becoming open-circuited.

A true safety circuit is a circuit which, if entirely removed, would still leave the system in an operative condition. Adequate protection requires systematic inspection of safety circuits of industrial-plant portables. It has been claimed by some that grounding to the circuit wire has an advantage because an open circuit in that wire automatically gives a warning that the device is unsafe to handle, having become inoperative. This reasoning, however, does not appear sound. Failure to operate generally means to the operator a fuse blown or current off, or something wrong with the tool, and no particular warning at all is registered. In any case he is not aware of the inoperative condition unless he is using or trying to use the tool, generally under his normal working conditions, and in that case he is subjected to the full hazard before he can possibly recognize any warning sign.

It would seem, therefore, that there are many serious objections to using the grounded-circuit wire for grounding metallic inclosures even assuming that its use can be restricted to those cases where water-piping systems of known low resistance are utilized for the earth electrode, which seems very doubtful.

The only difference between an artificial ground and a water system used for a ground is entirely one of resistance. It is quite possible to have an artificial ground of relatively low resistance, say less than 3 ohms, though usually expensive, and it is just as possible to have a high-resistance water ground, say higher than 25 ohms. The chances of a high-resistance water system ground are increasing constantly owing to the increase in the practice of using leadite joints in water mains. A recent report of the American Water Works Association indicates that joints of non-conducting material are being used in nearly 30 per cent of all new mains.

In considering costs it should be remembered that the grounded-circuit wire is not usually available at switch outlets, unless run there at extra cost. It is obvious that the cost of a knob-and-tube system, containing the necessary additional safety wire, cannot be a serious burden because there does not appear to be any great difference

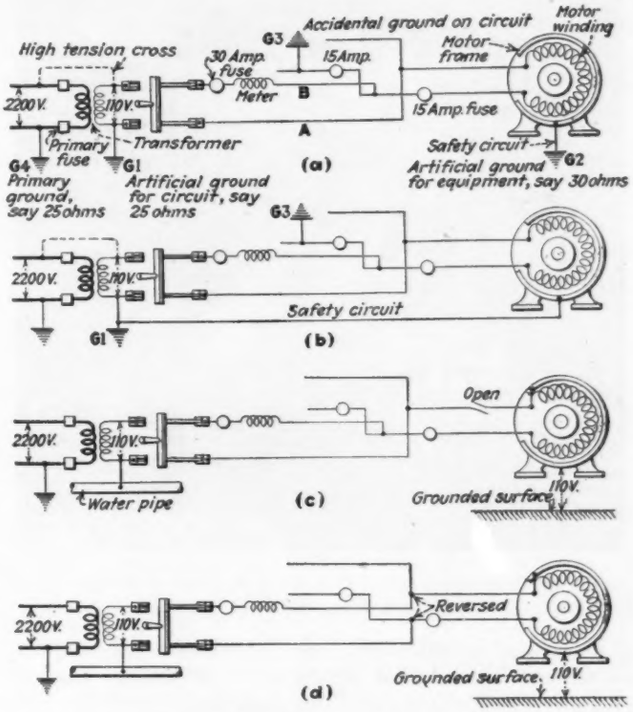


FIG. 2—GROUND CONDITIONS WHICH MAY OCCUR ON A SYSTEM

(a) Independent earth electrode for equipment ground.

(b) Where only a single electrode is used for grounding both the circuit and the equipment the apparatus would always have the same potential above ground as the conductor to which it is connected. A reversal or an open circuit of the grounded circuit wire would not result in any additional hazard.

(c) An open circuit of the grounded-circuit wire would place the frame at full potential to ground.

(d) A reversal will place the frame at full potential to ground. If the wiring has a metallic covering, a reversal will blow the fuse, but with these types of wiring there is nothing to be gained by this method of grounding.

in cost between knob-and-tube wiring with such necessary protection and most of the other systems which inherently possess such protection. If the grounded conductor is run to all switch outlets, with the idea of using it for grounding, the difference will be still further reduced, if not entirely eliminated or reversed.

It might be well to point out that the objections which apply to the use of the grounded-circuit wire for grounding equipment apply with equal force to the suggestion which has been sometimes made that the neutral or grounded-circuit wire does not need to be insulated. It should be as fully insulated as any other conductor of an interior wiring system.

Movable Lighting Unit Employed in Display Windows

ONE of the special features of the Northwestern Electric Company's merchandising quarters in the new Public Service building in Portland, Ore., is the use of movable window-lighting units. For lighting the nine windows, Frink multi-lamp ten-section, double-banked window lighting troughs were used. A special canopy housing the two banks of lamps is arranged so that it may be raised and lowered to provide effective lighting for different kinds of displays.

The operating mechanism, which was specially designed for the installation, is all overhead, so that there are no obstructions in the window and is self-locking in any position. A detachable crank operated from the floor is used to raise and lower the unit. Its range of movement is such that lamps or color screens may be changed from the floor of the window.

EFFECTIVE ILLUMINATION INSURED FOR APPLIANCE DISPLAYS BY MOVABLE LIGHTING UNITS

Each window has four circuits for the main lighting and a special circuit for spotlights, in addition to which there are outlets for two floodlights. Each window has an individual distribution cabinet with a master switch controlling all circuits. With this arrangement it is possible to make a window lighting set-up with the individual circuit switches and control the whole with the master switch, thus insuring the same lighting effect for any period of time desired.

A portable flasher may be attached to any two adjacent lighting cabinets in case it is desired to have automatic color changes.

Spectacular Signs Create Advertising Consciousness

IN SEEKING the location of the largest electric sign ELECTRICAL WORLD has been advised by Arthur Williams, vice-president of the New York Edison Company as follows: "I believe Atlantic City is entitled to this credit in the sign of the manufacturers of Chesterfield cigarettes. The size of the sign is stated to be 200 ft. x 60 ft. and is double-faced. It contains 26,000 lamps requiring approximately 500 kw. The estimated cost of the construction was, I understand, $325,000, and the annual cost of maintenance, including service, is said to exceed $100,000.

"The sign according to our reports was erected by R. C. Maxwell, of Trenton, New Jersey, and the changing effects are produced by the flasher of the James H. Betts Company.

"Visitors to Atlantic City are struck with the outstanding brilliancy and attractiveness of these signs along the ocean front. The electrical men of that city are certainly entitled to the gratitude of the entire electrical industry of the country. I imagine that no such lasting effect as to the value of electric signs in advertising is relatively possible anywhere else. In such a place as Atlantic City, men and women congregate from all over the country at a time when their minds are especially susceptible to receiving lasting impressions."

Utility Ascertains Appeal to Make in Range Advertising

DESIRING to determine the effectiveness of electric range advertising carried on during the past few years and to secure definite information upon which to base its future advertising, the Northwestern Electric Company, of Portland, Ore., made a check of 204 non-range users. Range salesmen called upon representative customers in their districts and after drawing the housewife into conversation concerning electric ranges, secured the following information by asking eight questions:

Question 1. What is your idea of the cost of an electric range?
61 per cent either did not know or thought that the cost was too high.
20 per cent answered "reasonable."

Question 2. What do you think of the monthly cost of electric cooking?
64 per cent answered "I don't know," "too high" or "expensive."
17 per cent answered "reasonable."

Question 3. Do you think the electric range of today is slow?
55 per cent answered "yes."
22 per cent answered "no."
15 per cent answered "I don't know."

Question 4. Do you know that the electric range is wonderfully clean and a big labor-saving device?
96 per cent answered "yes."
1.5 per cent answered "no."

Question 5. Do you know that the electric oven is equipped with a temperature control?
85 per cent answered "yes."
15 per cent answered "no."

Question 6. Do you know of the fine results obtained in baking with an electric oven?
66 per cent answered "yes."
31 per cent answered "no."

Question 7. Do you like to cook with gas?
43 per cent answered "no."
40 per cent answered "yes."
10 per cent answered "fairly well."

Question 8. What feature do you like best about gas?
70 per cent answered "It's fast."
15 per cent answered "everything about it."
10 per cent answered "nothing about it."

These replies clearly brought out the fact that six years of electric range advertising concentrated on temperature control and cleanliness had proved quite effective and that three important features—speed, cost of operation and price—which had been kept in the background in the advertising, should now be made the major theme of advertising and sales promotion literature.

Federal Control Is Issue

in Walsh Resolution*

Companies will assist. They have nothing to hide, but rather welcome complete investigation to clear the air and reassure public that situation is sound

By M. S. Sloan
President Brooklyn Edison Company

WHATEVER develops during the present session of Congress will be of importance not alone to utilities, but to every individual and institutional investor in their securities and to the general public as utility customers and taxpayers.

There are two elements in the situation at Washington. One is the proposal for a Senatorial investigation of gas and electric utilities and their financing. The second is, in essence, an effort to put the federal government into the electric power business. These elements are not as unconnected as they may seem at first glance. In fact, the proposal for an investigation is based in large part on an assumption that a power trust, so called, exists, and that government competition is necessary for the protection of the public.

On Dec. 17 Senator Walsh of Montana introduced his resolution of last year, somewhat amended, calling for appointment of a committee of five Senators to make an inquiry into gas and electric utilities, holding companies and engineering and management companies. The resolution, if finally adopted as presented, would authorize an inquiry into the financing of companies, their relations with holding, investment and management companies—opening the subject of the so-called power trust—the extent to which they may have used money or publicity to influence public opinion regarding municipal ownership of utilities, and whether they have endeavored to influence or control elections.

We are not opposed to an investigation. We are not afraid of an investigation. We are confident that an investigation which is fair and square, seeking a complete and accurate picture of the industry, endeavoring to deal seriously with a very complicated, technical subject, will not harm the utilities, but may, in the long run, be beneficial by setting at rest unfounded and misguided statements which are going the rounds. It ought to dispose finally of the notion that there is a vicious power trust. It ought to convince official critics of utilities that their rates are not extortionate, but are, instead, reasonable and being made lower whenever possible because it is good business for utilities and public alike to have rates as low as they can be and still allow the companies to earn adequate compensation.

It ought to prove that mergers of utilities are a logical and inevitable development of the business, beneficial alike to customers and companies. It ought to prove that holding companies, so called, have been the only agency by which many sections of the country could get better utility service and lower rates. Through these companies, utility units, not strong individually, have been grouped so that adequate financing was possible, economical operation and better service became possible, and frequently lower rates have been put into effect. As greater sales of service have resulted, the local utilities have benefited and the holding companies have been recompensed for their effort and investment.

If an investigation is held, the utilities can be counted on to co-operate. They have nothing to hide; their affairs are not secret. They are operated under the supervision and regulation of public officials; they make sworn reports in great detail to these officials; they keep books according to commission requirements. They have to obtain official authorization for capital increases, rate changes, mergers.

We in the utility business believe we are doing a good job—a job of real value to all elements of the public—and if an investigation is necessary to convince skeptics, we do not intend to fight it even if we cannot see why it should be considered necessary. There's another point I want to emphasize. The utility industry is no more nor less than the individuals who compose it. If there are weak brethren in it, as there may possibly be—if somewhere along the line there have been improper acts or policies by individuals or individual companies—we say let them be shown and known as such. We do not want to see them charged against the industry. The industry, I know, would not defend them or excuse them. It would, on the contrary, do whatever could be done to help prevent anything of the sort in future.

Opposed to Government in Business

The second element in the situation at Washington is the issue of government in business. Muscle Shoals will be discussed again. Shall the plant be sold? Shall government operate it to make nitrates, or to make power? Shall government lease it to the group of Southern power companies, or to somebody who will produce fertilizer? Because of a new process of making nitrates, government opinion seems to be coming around to the view that it would be uneconomic to devote the plant to that purpose. So far as I can see, that is the one new phase which makes the situation different from what it has been in previous years.

Then we have the Swing-Johnson Boulder Dam bills. This project has been before Congress for a number of years; its advocates hope to get it adopted this session.

**Address before N.E.L.A. committee on relations with financial institutions, Eastern Geographic Division.*

The project is put forward, first, as a flood control measure to protect the Imperial Valley; second, as an irrigation measure—it is said it would double the area of irrigated land in the valley; third, as a means of supplying domestic water to Los Angeles and, perhaps, other communities in southern California. Its advocates say the entire cost could be met by proceeds of the sale of the power which would be developed.

The electrical industry has gone on record in opposition to these bills as they stand. We are not opposed to flood control by the government in this case, if that is the only agency which can bring about relief—and apparently the seven states in the Colorado River Basin find it impossible to get together and stay together on all the points involved in this matter. We are not opposed to irrigation of desert lands, where it is proved to be a desirable and economic undertaking. We are absolutely opposed to putting the federal government into the electrical business to pay for flood control, or for irrigation, or for a domestic water supply for any community or group of communities. If flood control and irrigation are necessary and desirable, the construction costs should be paid from taxes and the expenditure considered legitimate. If Los Angeles and other communities need more water, why should they not procure it at their own expense as other cities have to?

Doubtful if Boulder Dam Power Will Pay Interest on Investment

We are not opposed to a complete, scientific development of the Colorado River which shall utilize its waters for all purposes. There should be a revenue for government from the power developed; but it is not necessary to put the government into the power business to obtain that revenue. It could be handled under the provisions of the federal water power act with entire justice to the government and the electrical industry, we believe. In fact, we believe the government would be far surer of a satisfactory revenue under those conditions than if the pending legislation were passed and the government went into business at Boulder Dam.

This project contemplates a feat of engineering such as has never yet been attempted. The estimate of $125,000,000 cost, under the circumstances, is merely a guess. Other engineers have guessed $200,000,000—the cost might easily run a great deal higher than that. The success of the whole enterprise, from the point of view of power, is dependent on the cost. Boulder Dam power must be sold in Los Angeles and that vicinity in competition with any other power supply there. It must be transmitted 250 miles to its market. That market is already fully supplied, and will have to continue to be supplied during the ten years which it is estimated will elapse before Boulder Dam power can be delivered. Electric energy generated by steam is now being produced in Los Angeles at a lower cost than that estimated for Boulder Dam power delivered there and ten years hence power from stream will, without much doubt, be cheaper than it is now, owing to constant improvements in steam generation of electricity. It has been figured—on a basis of $200,000,000 cost—that Boulder Dam power, if and when it is deliverable, cannot be sold for a price that will pay the interest charges on the development, let alone operating charges and amortization of principal.

Power developed and sold by the federal government, therefore, cannot be expected to take care of the costs of this project on any honest system of bookkeeping. But power should not be expected to. The construction costs would be attributable to three purposes: flood prevention, irrigation, power development. The plain, straightforward, business-like thing to do, it seems to me, would be to allocate them in that fashion. Let the power phase of the project be handled in accordance with the federal power act. Let the power house be built, in accordance with the terms of that act, by the highest bidder for the privilege. Power then would not be saddled with the costs of flood prevention and irrigation. Boulder Dam power, under such conditions, might be carried to Los Angeles and sold in the market along with the low-cost steam power generated there. The government would be relieved of a considerable initial expenditure, and it would be assured a revenue. That seems to me reasonable, just and equitable for all interested in this situation. It would not depart from the present policy of the government as to water power development, and it would not put the government into the power business.

Separate Project for Flood Prevention

There is another point to be considered in respect to Boulder Dam. Eminent engineers, some of them in government service, have carefully considered another site on the Colorado River for a dam for flood prevention. A dam built at Topok, further down the river, for flood prevention only, would cost only $15,000,000, and it is said would offer more real protection to Imperial Valley against floods than Boulder Dam. A word on this subject of floods. A great many people undoubtedly vision something like the Mississippi disaster, with much loss of life. There would be property damage, but there is no likelihood of loss of life.

Cut out the power phase of this project and what is there left? Flood control, which could unquestionably be accomplished by a dam elsewhere, and perhaps better and at less expense. As to the wisdom of irrigation, both practical and economic, there is much question. As to the domestic water supply, there is great division of opinion whether or not Los Angeles has not sufficient and satisfactory sources of supply entirely outside the Colorado River, and whether or not that would be a satisfactory supply under any condition because of the silt and mineral salts the water carries.

The nub of this problem, therefore, is the government development of power at Boulder Dam. I doubt very much whether the agitation for this project could have been sustained over a number of years—whether it could be kept up now—if the idea had not been put out that it "would not cost anything." Yet that phase of the matter is more dubious, more questionable, than any of the other phases. And if it falls, the whole scheme falls.

Boulder Dam is highly important because what is done in this instance will serve as a precedent for others. A similar scheme is being agitated for the Columbia River. It is sought to apply the same idea to developments on the Tennessee. It has been suggested that power could be made to pay a large part, perhaps all, of the costs of flood control on the Mississippi. What we must consider, therefore, is not this one item—government in the power business on the Colorado—but government in business in many parts of the country.

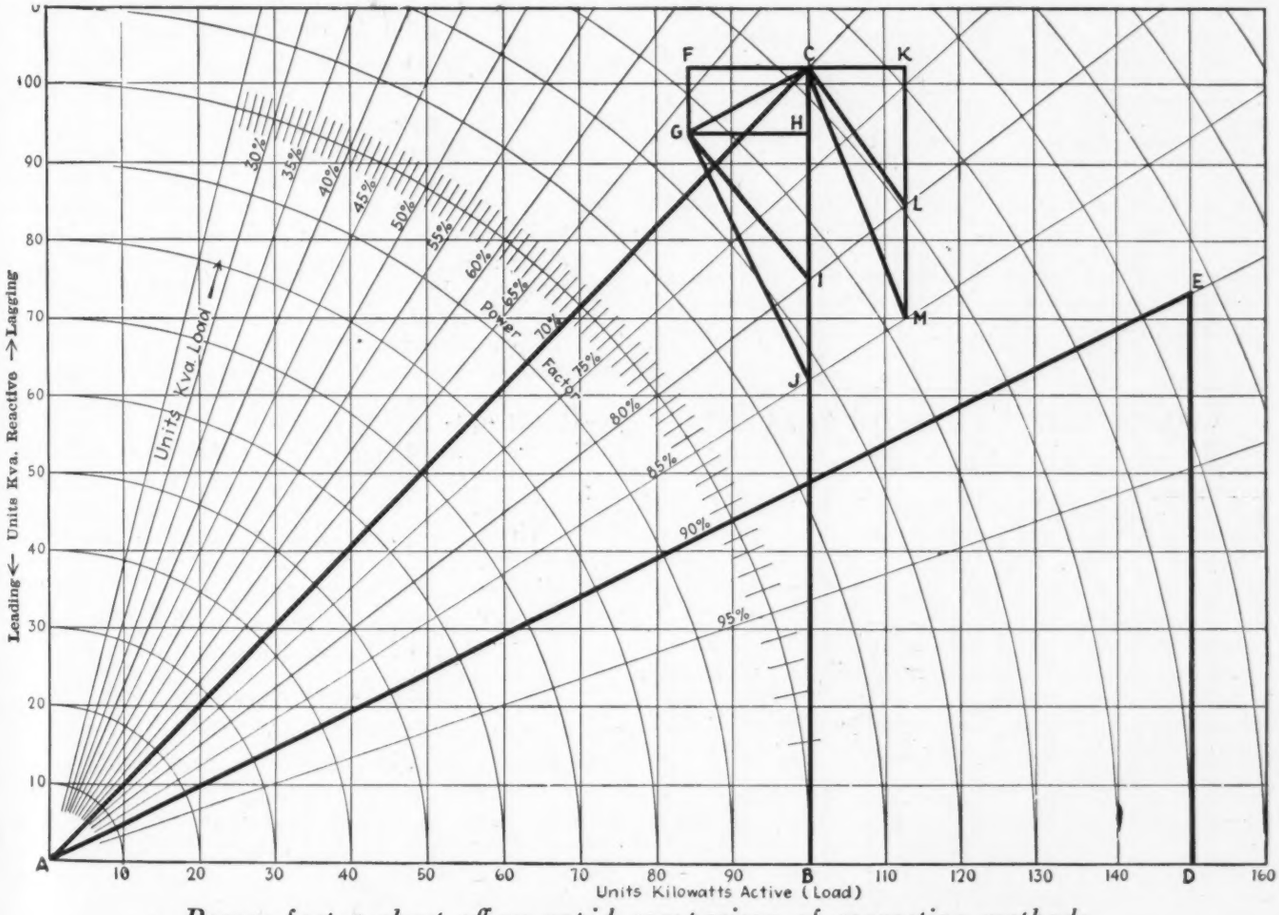
Is it for the best interests of this country to have the government in the power business? President Coolidge said recently that once government entered business it could not stop short of absolute monopoly. Is that what we want in this country, in the electrical business or any other?

Determining Customer Costs

A STUDY of the cost of serving residential and commercial customers by the Cambridge (Mass.) Electric Light Company recently resulted in a minimum of $11.23 per year as the direct customer cost, including certain operating expenses and overhead. The average number of residential customers in 1926 was 19,329 and commercial customers averaged 3,467. The operating expenses of the company assignable to the former group totaled $154,077 and to the latter $27,619, or $7.97 average per customer. Property values (based on reproduction cost, less depreciation) directly assignable to these customers totaled $854,287 for a maximum number of 20,968 residential customers, and $146,100 for a maximum of 3,589 commercial customers during the year. The average property value prorated per customer was $40.74, and charges on this sum at 8 per cent per annum totaled $3.26, giving a total of $11.23, or $2.23 more than the 75 cents per month service charge proposed by the company in connection with the adjudication of its rates by the Massachusetts Department of Public Utilities. The foregoing analysis included no allowance for operating expenses or property values assignable to either demand, energy or revenue groups of costs.

Corrective Power Factor Plans Readily Compared

RAPID computation of problems encountered in efforts to secure better power factor conditions at the customer's plant is secured through the use of the accompanying chart by the power representatives of Public Service Electric & Gas Company (New Jersey). This device offers a means of ready reckoning for the comparative merits of achieving corrective kilovolt-amperage by the use of static condensers, by replacement of an induction motor by synchronous equipment and by addition of synchronous motors to existing loads.



Power factor chart offers rapid comparison of corrective methods

EXAMPLE: Customer has 1,000-kw. load at 70 per cent power factor. Customer's circuit conditions are as follows, referring to chart: AB = 1,000-kw. active load. BC = 1,010-kva. reactive and AC = 1,420-kva. load (scale 10 to 1). To correct this customer's load to 80 per cent power factor, using three different methods:

First.—By means of a static condenser. Condenser should have 265-kva. capacity, represented by CI (nearest commercial size static condenser should be selected). For correction to 85 per cent power factor static condenser would have CJ, or 390 kva.

Second.—By means of a synchronous condenser to replace an existing induction motor which is in constant use and raise the power factor to 80 per cent. Assume customer has a 225-hp. induction motor operating constantly at full load and 90 per cent power factor. Kilowatt input to motor = 225 × 0.746 × 0.90 = 150. Triangle ADE represents to full scale the conditions on this induction motor and shows reactive kilovolt-amperage of DE, or 72 kva. From point C lay off triangle CFG (scale 10 to 1), which represents the 225-hp. motor taken off the customer's circuit (CF representing 150-kw. load taken away and FG representing 72-kva. reactive). The synchronous motor to be added to customer's circuit will have mechanical load of 150 kw., or GH, and a leading reactive kilovolt-amperage of HI (note this is projected downward to the 80 per cent line, as it is leading). The kilovolt-amperage of the synchronous motor will, therefore, be GI, or 250 kva. In most instances it would be best to figure on correcting power factor to 85 per cent, in which case leading reactive kilovolt-amperage would be HJ and kilovolt-amperage will be CJ, or 350 kva.

Third.—By means of a synchronous condenser to carry additional mechanical load (motor to be in constant use) and raise the power factor to 80 per cent. Assume customer puts on his circuit a synchronous motor to drive an air compressor which will run constantly, the mechanical load on synchronous motor to be 175 hp., or 130 kw. From point C lay off CK = 130 kw. additional load on customer's circuit, then KL, or 165 kva., represents the leading reactive necessary in the synchronous motor to bring power factor of customer's circuit up to 80 per cent. The capacity of the synchronous motor is represented by CL, which equals 210 kva. In order to provide for future requirements of customer's circuit it would be best to figure on correcting his circuit to 85 per cent power factor, in which case the capacity of the synchronous motor is represented by CM, which equals 330 kva.

NOTE: Efficiencies of induction motors and synchronous condensers not taken into account in above calculation.

Borings Reclaimed at $20 per Ton With Electricity

THE melting of malleable and gray iron in electric furnaces is a comparatively recent development. A new installation of an arc-type electric furnace for this work has been completed in Milwaukee, on which the operating costs were quoted by O. O. Wagley of the Milwaukee Electric Railway & Light Company at the commercial section meeting of the Wisconsin Utilities Association.

In this furnace gray iron borings from the manufacturer's machine shop are utilized. This type of scrap has very small market value and conversion of this material into high-grade castings has great possibilities. The following summary shows the operating costs of this trial installation for melting 49.1 tons of gray iron borings:

1. Power costs—580 kw.-hr. per ton at 1 cent per kw.-hr	$5.80
2. Lining costs—49.1 tons borings melted with $64 lining plus $7.50 patching material, 304 heats averaging 323 lb. each	1.46
3. Electrode cost, 9.03 lb. per ton at 25c. per lb	2.34
4. Labor cost, one man at 75c. per hour, producing 1,000 lb. of metal. Cost per ton	1.50
5. Boring cost, market price per net ton, f.o.b. Milwaukee	8.90
6. Melting loss, 4 per cent of $8.90	.35
Total melting cost per net ton	$20.35

The advantages of these operating costs can readily be appreciated when it is considered that a melting cost of $28 is considered good practice with ordinary cupola operation.

Carbonizing Furnaces Earn Cost in One Year

IN THE manufacture of automobiles, tractors, and many other types of equipment where there is much carbonizing or case hardening to be done, electric furnaces have been found very well suited for this work, and, from the central station standpoint, this is an important application of electric heating.

One large tractor manufacturer in Milwaukee installed two pusher-type furnaces at a cost of $85,000. While the cost of electric heat about equals the cost of oil fuel formerly used, there are great savings made in labor, in building space, and in quality of product. Instead of twelve employees per shift, five now do the work. The floor space, formerly crowded when carbonizing the parts for 40 tractors per day with oil-fired furnaces, is now adequate for a production of parts for 120 tractors a day. Instead of a large percentage of rejects, the uniformity of results from the electric furnaces is such that there are almost no rejects, and the cost of inspection is reduced. The electric furnaces paid for themselves in one year's operation. The operating economy of the recuperative type of furnace such as that installed is shown in the accompanying tabulation.

OPERATING ECONOMY OF ELECTRIC RECUPERATIVE CARBONIZING FURNACE

Chamber No.	Gross Weight per Hour Lbs.	Depth of Case, Inches	Kw.-Hr. per Ton
1	945	⅜	175
2	946	⅜	165
3	760	⅜	171
4	728	⅜	174
5	720	⅜	180

These data were taken on five furnaces operating in one plant and cover a regular production period of one week. It is interesting to note that the daily power consumption of the five furnaces averages 8,600 kw.-hr., resulting in a revenue of $86 per day. These furnaces are operated seven days a week, including Saturdays and Sundays, giving a load factor of approximately 90 per cent, with an operating power factor of about 95 per cent. The process results, being greatly improved, add to the factor of cost savings.

Letters from Our Readers

Times Have Changed

To the Editor of the ELECTRICAL WORLD:

"Less than ten years ago we installed electricity upon our farm. My husband was instrumental in getting a line extended in our direction. At that time we had to build the main line ourselves (by 'we' I mean the few neighbors who combined to get this done), wire our own buildings and put up our own transformers. Then, on making a gift of the line to the nearby electric company, it supplied us with juice at a very high rate. But times have changed. Since the small electric companies have become absorbed by large corporations they are able to do far more at extending lines and keeping them in repair than it was possible for local companies to do because of their lack of capital."

The above paragraph is quoted from an article on electricity in the farm home written by a farmer's wife and published in *Successful Farming* for February, 1928. The article is significant because it indicates that the farmer receives, and knows that he receives, a direct economic benefit from large aggregations of capital in the electricity supply industry. CONTRIBUTOR.

Chicago, Ill.

The Three Prestons

To the Editor of the ELECTRICAL WORLD:

Stop for a moment counting up how many Smiths, Browns and Johnsons there are in the United States and consider the uniqueness of the fact that there are three officers of the Association of Edison Illuminating Companies who answer to the name of Preston. To begin with there is H. Preston Liversidge, who is the president. Mr. Liversidge is vice-president and general manager of the Philadelphia Electric Company. Next is Preston S. Arkwright, president of the Georgia Power Company, Atlanta, who is vice-president of the association. And then there is the executive secretary, who is Preston S. Millar of New York City.

As Mr. Arkwright said in commenting upon the similarity of names, it would not be quite so noticeable if the name was "Bob," or "John," or "Percy," or "Algernon," but "Preston" is a little out of the ordinary run of names. "At least there should be co-operation and harmony among the three Prestons," Mr. Arkwright commented. BYSTANDER.

Atlanta, Ga.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Coal Measuring vs. Weighing for Power Houses.—J. E. LEA.—The author has proceeded upon the assumption that the measurement or weighing of coal is seldom accurately determined. Surface moisture is judged to be the cause of the major discrepancies and it is suggested that an hydraulic principle of measurement which will be continuous instead of intermittent, so that the rate of flow can be determined and so that large quantities may be dealt with in a simple, expeditious and accurate maner, is desirable. The hydraulic principle is based upon the postulate that small coal can be regarded as far as measurement is concerned, as a liquid or at least to such an extent that the principles of hydraulics can be applied to the determination of its volume and weight.—*The Electrician (England)*, Dec. 30, 1927.

Pulverized Fuel for Power Stations.—G. H. LAKE.—Summarized results of burner-operating tests are given for the Derby generating station in England. Several innovations in steam-superheating and coal-preparing practices have been introduced in the design of this station and, as a result, unusually high economies have been obtained. The author has included detailed costs of coal consumed and of maintenance factors for the various items entering into the pulverized fuel installation. The reduction of these charges to the basis of cost per ton of fuel consumed offers an interesting contribution.—*The Electrician (England)*, Dec. 23, 1927.

Transmission, Substations and Distribution

Automatic and Remotely Controlled Substations.—Data regarding automatic substations and those remotely controlled through supervisory direction have been compiled for a number of stations, and information regarding capacity, date of placing in service, the manufacturer of the equipment, the automatic features, the supervision, frequency of inspection, and details of the control circuit, are included for substantially all the stations listed in the present discussion. Recent developments in equipment for this purpose are covered in statements by two large manufacturers and a producer of special equipment. Improvements in and additions to the devices included in such stations are dealt with.—*Serial Report, Electrical Apparatus Committee, National Electric Light Association*, November, 1927.

132,000-Volt, Single-Conductor, Lead-Covered Cable.—P. TORCHIO.—The development of the economic and commercial demand for oil filled 132,000-volt cable is outlined. It is stated that this tvpe of cable permits direct interconnection with high-voltage overhead lines and it is felt that the satisfactory operation of the two lines which have been placed in service this year offer an indication that 220,000-volt cable can be constructed without material changes in design. Particular reference is made to the effect upon the dielectric of occluded gas and to the method of eliminating trouble from this cause in the oil-filled type. The manufacture, inspection and testing of the cable and equipment is also reviewed, and, as the result of tests, it is indicated that the electrical constants of the cable are substantially unchanged by normal temperature cycles. Inspection, indication of oil leaks, and cable and joint repairs as developed in the New York and Chicago installations and the replacement of a length in one section which developed a leak in the sheath, are also covered. — *Report, American Institute of Electrical Engineers*, November, 1927.

Generation, Control, Switching and Protection

Fire Protection of Generators.—J. BRANDL.—The ease of storing and inert character toward electric arcs makes carbon-dioxide the most desirable quenching gas for electric fires in generators. Steel cylinders, containing the liquified gas, can be located near each protected object, or a centralized cylinder battery can be provided. Neither a pressure gage nor a gage showing the liquid are reliable indicators of the amount of CO_2 left in the cylinders. The only dependable method is to install the cylinder battery permanently upon a small platform scale and to balance the load. Special precautions are necessary to avoid freezing and the forming of snow when the gas is released. Dampers or movable louvers are advocated to restrict the escape of the gas, unless the machine is of the closed circulation type.—*Elektrotechnische Zeitschrift*, Dec. 1, 1927.

Units, Measurements and Instruments

A Two-Range, Vacuum Tube Voltmeter.—C. M. JANSKY, JR. and C. B. FELDMAN.—The design, uses and limitations of a new circuit employing the three-element vacuum tube as a voltmeter are discussed. The two overlapping ranges of voltage, together with a single operating battery are the unusual features. The effect of wave-form and the elimination of that effect are treated. It is stated that frequency has but little effect on the operation and this effect can be eliminated by use of a by-passing condenser; the imput impedance is high, of the order of several megohms, and the power factor is low; differences in wave-form are exaggerated but not, for commercial wave-forms, objectionably so; the sensitivity is higher than that of most other communication-frequency measuring instruments; the range is inherently low, covering probably a band of voltages from a tenth or a few tenths of a volt to about ten volts. The stability of calibration over the entire life of the tube is questionable. Experiment showed, however, that, in general, the calibration could be expected to remain constant for periods of operation of more than 40 hours.—*Report, American Institute of Electrical Engineers*, November, 1927.

Standardization of Terminal Chambers for Single-Phase and Polyphase Watt-Hour Meters.—The standardization agreed to by utilities and manufacturers is clearly presented. This standardization, it is anticipated, will result in considerable saving, as the installation of the meters will be simplified, and as the number, sizes and types of adapters will be greatly reduced. The adapters were relatively costly, and now that a simple standard arrangement can be utilized, the cost should be decreased. Aside from this saving, the details in connection with the installation of watt-hour meters are simplified, so that any meter available in utility storerooms can be installed on any equipment provided with a standard end wall.—*Serial Report of the Meter Committee, National Electric Light Association*, 1927.

Heat Applications and Material Handling

The Davies Magnetic Separator for Ores. — An electro-magnetic apparatus suitable for the separation and concentration of any magnetic material, whether highly or weakly magnetic, has been devised. The design of the equipment utilizes the lines of force emanating from pole pieces, and, by rendering certain bands magnetic, it is possible to remove materials of high magnetic permeability from the mineral under treatment before it enters the magnetic field proper.—*Engineering (England)* Dec. 9, 1927.

Rectifiers for Dock Cranes.—W. WALTZ.—The article gives a description of dock installations where the power for numerous loading cranes was formerly supplied by a motor-generator substation. The demand of such installations varies almost continuously between low and double normal load in a succession of short peaks, so that the motor-generators formerly used were equipped with heavy flywheels. The average over-all efficiency and the power factor of the driving motor were both low. Conditions were materially improved by the substitution of mercury-arc rectifiers in place of the motor-

generator sets. Efficiency and power factor of these rectifiers are almost constant from one-quarter load up. Measurements, continued for a number of days, indicated an average efficiency of 67.8 per cent and 92.6 per cent respectively before and after the remodeling of one of these two installations.—*Brown, Boveri Mitteilungen,* December, 1927.

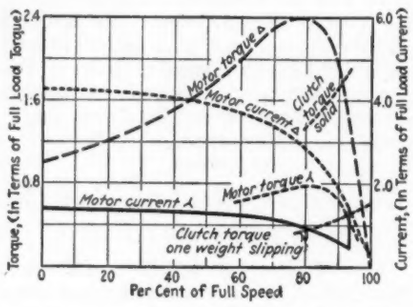
Electrophysics, Electrochemistry and Batteries

Peculiar Behavior of Transformer Oil. — A. SCHWAIGER. — The dielectric strength of oil can be greatly increased by thoroughly removing all traces of its water component. It is stated that if puncture tests are made on three grades of oil with (1) plate electrodes, (2) sphere electrodes and (3) sharp edge electrodes and the results are plotted into a logarithmic coordinate system it will be found that the plates give a straight line, the spheres give an upward bent curve, while the sharp electrodes show a decidedly downward bent line. In other words, for spheres under oil the strength of the oil should be raised as high as possible. For sharp electrodes an increase beyond a certain limit is almost useless. It seems, therefore, that the content of water is useful with sharp electrodes and detrimental with spheres. The author explains this by the fact that the water particles are attracted toward the electrodes and thus tend to make sharp edges more round, while they upset the sphericity of balls, tending to concentrate the field. Since more or less sharp edges are much more frequently found on apparatus than spheres or plates, dielectric strength data of oil based on sphere electrodes are misleading as to what could be expected from drier oil. *Elektrotechnische Zeitschrift,* Nov. 10, 1927.

Insulating Materials for Electric Machines. — L. FLEISCHMANN. — Solid insulating materials, such as are in extensive use on electric machines, transformers and apparatus, require a much more careful selection than metallic parts, as their electrical and mechanical properties are not constant, but are affected by a number of circumstances, such as heat, humidity, chemical changes, etc. Furthermore, these changes are not proportional to the variations of the influencing factors, nor can the laws of change be expressed in an exacting mathematical manner. In most cases, experimental work with tabulated or graphically represented results is the only basis for proper selection. A further aggravating factor is introduced by the possibility of the pressure of non-homogeneous material or air-filled voids. A test is described to measure the surface creep over built-up mica insulation to show how distance and thickness affect the flash-over. A characteristic compound puncture curve is given to illustrate how temperature affects the dielectric stress. — *Elektrotechnische Zeitschrift,* Nov. 3, 1927.

Motors and Control

Squirrel-Cage Induction Motors. — D. B. HOSEASON.—A general discussion of the characteristics and comparative value of squirrel-cage induction motors, with particular references to means of improving their starting performance. It is stated that the squirrel-cage motor has usually both a higher efficiency and a higher power factor than the corresponding slip-ring motor and that for general industrial work it is a more profitable investment than any of the alternatives available. On the score of reliability, it is stated that it has distinct advantages in that breakdowns of machines are distributed 63 per cent on armatures, commutators, slip-rings and brush gears, while but 37 per cent occur elsewhere. It is stated that the squirrel-cage motor has a probability of breakdown of about 45 per cent of that of electrical machines in general. A recently devised centrifugal clutch, consisting of plates pressed together by weights normally held out of operation by springs, offers greatly improved starting performance, and the accompanying curve indicates the characteristics obtained through the equipment of a motor with this device.—*Electrical Review* (*England*), Dec. 23, 1927.



MECHANICAL CLUTCH IMPROVES CHARACTERISTICS OF SQUIRREL-CAGE MOTOR

Capacitors.—M. C. LOWE.—The fundamental considerations involved in the use of capacitors and the general character of the problems involved in their application to utility and industrial work are mentioned. The use of capacitors as lightning arrestors as well as for power-factor correction is indicated as being a promising development toward which very little has been done. The advantages of capacitors over other devices for the rectification of power-factor are mentioned, as, the elimination of attendants; minimized operating losses; reduced line losses; flexibility of size with capacity requirements; and full agreement with underwriters specifications without special provision.— *Electrical News* (*Canada*), Jan. 1, 1928.

Telegraphy, Telephony, Radio and Signals

The Vacuum Tube Rectifier.—JOHN H. KUHLMANN and JAMES P. BARTON. —An investigation undertaken by means of oscillographic and vacuum tube voltmeter methods has been applied to the B-voltage supply for radio receivers. The object of the determination was to observe possible opportunities for improvement in the design of such rectifiers as well as the most satisfactory type of filter circuits and the appropriate values of inductance and capacitance which will give a direct current output delivered with the least practicable voltage drop and having no fluctuation of sufficient magnitude to interfere with the proper operation of the set. The vacuum-tube peak voltmeter used to detect very small fluctuations is described. The author concludes that the voltage drop in the filter circuit should not be high and that the series inductance should not be larger than required to produce a current without ripples.— *Journal American Institute of Electrical Engineers,* January, 1928.

Miscellaneous

The Effect of Running In on Journal Bearing Performance.—F. A. MCKEE. —A feature recognized by the operators of machines containing journal bearings is that a certain amount of "limbering up" or "running in" is necessary before this type of bearing behaves in a normal manner. The author has described an investigation conducted by the Bureau of Standards, the object of which was to evaluate this effect of running in upon the performance of babbitted, full-journal bearings. A specially designed journal-bearing friction machine provided a method of measuring the frictional loss when operating under different conditions of load, speed of the journal and viscosity of the lubricant. By correlating these factors in a suitable manner, a measure of the effect of progressive amounts of running in on bearing performance was obtained. The results indicate that running in causes a marked reduction in the frictional loss of a bearing under very severe operating conditions. The effect upon the factor of safety is pointed out, and the possibility of increasing the efficiency of high-speed journal bearings is indicated by a hypothetical example of a steam-turbine bearing.—*Mechanical Engineering,* December, 1927.

The Design of Condenser Bushings —A quick method of designing condenser bushings is described. The procedure has been developed for uniform axial and radial potential gradients, assuming infinitely thin layers and also finite thicknesses; the design for uniform axial stress with the use of layers of unequal thickness, has also been worked out. It is stated that the rapidity with which the tabulation may be made and the idea of the nature of the result obtainable is of considerable importance. A number of influences, including length of mounting, diameter of the conductor, and tangential and radial stresses, have been considered and investigated in order to obtain the best arrangement and dimensions. Various formulas and characteristic curves aid in the development of usable information.—*The Electrical Review* (*England*), Dec. 9, 1927.

News of the Industry

Amended Walsh Resolution Approved

Language Altered in Effort to Confine Investigation to Interstate and Federal Matters—Move to Substitute Trade Commission as Agency for Inquiry Lost on Tie Vote

By Paul Wooton
Washington Correspondent of Electrical World

AN INVESTIGATION of the electric and gas public utilities doing an interstate business was on Feb. 1 recommended by the interstate commerce committee of the Senate as a result of its hearings on the Walsh resolution. The committee recommends that the investigation be conducted by a special committee of the Senate. An effort to have the investigation made by the Federal Trade Commission was lost on a tie vote—nine to nine. Before reporting out the resolution, the committee amended the proposal of Senator Walsh so as to limit the investigation to public utility corporations doing an interstate business and to corporations holding the stocks of two or more public utility corporations operating in different states.

The resolution thus amended was not satisfactory to Senator Wheeler of Montana, Senator Howell of Nebraska and Senator Black of Alabama. They announced their intention of submitting a minority report, which, it is understood, will ask an inquiry into all election campaign contributions of power companies, as proposed in the original resolution. The committee left in the Walsh resolution the provision to investigate expenditures looking to the influencing of public opinion against public ownership. The investigation as to expenditures intended to influence elections was limited so as to refer only to the election of federal officials.

While the amended resolution is unsatisfactory to some of the advocates of the Walsh resolution, its scope has not, it is believed, been restricted to the point where it will meet the approval of those members of the Senate who see in it an unwarranted intrusion into the jurisdiction of the several states. For this reason difficulty may be experienced in bringing about its adoption.

Ainey on Joint State Regulation

William D. B. Ainey, chairman of the Public Service Commission of Pennsylvania, told the committee at its last session, on Thursday, Jan. 26, that in his opinion Senator Walsh's proposed modification extended the resolution rather than restricted it. Senator Walsh asked if he would like to have it withdrawn. Mr. Ainey said it would be a fine thing if he would withdraw it, and "in so far as the red thread of interference with state regulation and authority is concerned, I would be delighted if you would go a step further and withdraw the whole resolution." In discussing the ability of the states to handle regulatory questions when the power is generated in one state and used in another, Mr. Ainey declared that "in working out the Conowingo project co-operatively between the Maryland commission and the Pennsylvania commission we solved every single interstate regulatory matter that could be involved in that great project."

Ransom Makes Legal Argument

Final argument on behalf of the Joint Committee of the National Utility Associations was made by William L. Ransom of New York. He said that all the committee had to decide was whether a prima facie case had been made and, if it had, what were the reasonable principles of limitations which should be written into the resolution. He pointed out that Senator Walsh had conceded that power to investigate is limited by the power to legislate. "To talk about investigating an industry," said Mr. Ransom, "is a round phase, but the thing to keep in mind when you investigate an industry, if you call it that, is that what you really investigate is companies, local companies; that what you really bring here is Tom Brown and Ralph Jones and books and papers of the companies operating in the states of the Union. And what you adopt, when you talk about investigating an industry, is that, at the election of your committee, the officers, accounts and vouchers of 3,500 companies in every or any part of this country may be brought by subpœna of any senator for overhauling.

"The resolution as it stands," Mr. Ransom continued, "means the banks in any town. It means the local companies and concerns that do construction service in any county or in any town, the local citizens engaged in local business in any city, village or section of the United States—not only capitalization of utilities, not only capitalization of holding companies, but the capitalization and the increase in capital assets and capital liabilities of all these non-utility corporations."

In his analysis of the matter Mr. Ransom found that only four grounds of possible jurisdiction had been mentioned. They were the transmission of electrical energy and gas across state borders, the interstate sale and transportation of utility securities, the restraint of trade and the exclusion of fraudulent securities from the mails.

Mr. Ransom admitted that Congress had the power to legislate and, as a consequence, to investigate interstate transmission, but maintained that the investigation should not be by a special committee of Congress. He pointed out that the Supreme Court had held that the regulatory power is not limited by the price paid for power at wholesale or the cost at wholesale, but that the courts and the state commissions may inquire what is a reasonable price under all circumstances. In connection with Senator Walsh's charge that a part of the capitalization of the utilities "is pure water or thin air," Mr. Ransom brought forth voluminous evidence to prove that "there is considerably more than a dollar of fixed tangible property on the original-cost basis for every dollar of capitalization of holding company or of security." He contended that ownership of stock in companies in other states is not interstate commerce and does not subject the owner to federal legislation or investigation and that the issuance of bonds or stocks is not interstate commerce. Whether or not the sale and transportation of bonds and stocks constitutes interstate commerce has not been passed upon by the Supreme Court of the United States, Mr. Ransom said, but the Supreme Court has held that the issuance and sale of insurance is not interstate commerce. It also has been held that the use of the mails for business transactions does not constitute interstate commerce; but, even granting the power to investigate and to legislate as to the interstate sale of securities, Mr. Ransom made the point that it would not confer on Congress the power to investigate the production of the securities, which is a function reserved to the states.

Massachusetts Commission Cuts Cambridge Rates

Petitions which have for some time been before the Massachusetts Department of Public Utilities asking a reduction in the rates of the Cambridge Electric Light Company were acted upon on Monday of this week, when the department made an order reducing the maximum rate of that company for domestic and commercial lighting from 8 cents to 5½ cents a kilowatt-hour, which, the department estimates, will bring to the customers a yearly saving of not more than $318,805 on the basis of 1926 consumption. No order was made affecting

power and street-lighting rates. The company's request for a two-part rate based on floor area was not approved, nor was its petition for a service charge, though the department expressed willingness to sanction a service charge of 50 cents a month if the net maximum kilowatt-hour rate were made 4 cents.

Detroit Edison Budget

Thirty-Million-Dollar Expansion Program — Sixth 50,000-Kw. Unit at Trenton Channel and Fifth Turbine at Marysville Will Go Into Service

THE Detroit Edison Company expects to add 50,000 kw. to its peak load this year and to connect twenty-five thousand new customers. To do this it will expend about $30,000,000, of which $8,862,700 will go for power plants, $5,283,100 for substations, $5,042,000 for transmission lines and the rest for new-business promotion, the heating department and miscellaneous equipment, construction and overhead.

The sixth and last 50,000-kw. turbine for the Trenton Channel plant (bringing its rating to 300,000 kw.) is to go into service next fall. Trenton Channel is the only power plant operated by the Detroit Edison Company in which the generating units are substantially identical, and this desirable feature makes a new departure in "spare parts" possible, namely, the purchase of a spare steam rotor, which may be used in any one of the six turbines at Trenton Channel or in one of the two turbines which are destined for Delray Plant No. 3. On the latter plant work will be continued this year, so that the turbines of 50,000 kw. each and four boilers will be ready for service late in 1929. The fifth turbine at the Marysville plant is a 30,000-kw. machine. It is due to go into service May 15. This makes three "thirties" and two "tens" at Marysville, giving a total rated capacity of 110,000 kw. The new 30,000-kw. turbine at Marysville, with the 50,000-kw. turbine at Trenton Channel, will add 80,000 kw. to generating capacity during 1928.

There are now in service three double-circuit, 120,000-volt steel-tower transmission lines connecting the Trenton Channel power plant with the Navarre and West Warren stepdown substations in Detroit. It is planned to add a fourth line during 1928. There is one double-circuit, 120,000-volt line from the Marysville power plant to the Northeast substation in Detroit, and this is to be supplemented by the completion of an additional single-circuit tower line. The interconnection with Consumers Power Company is almost complete and is to go into service early this year. The line is to operate at 132,000 volts. The interconnection will furnish a valuable reserve in case of breakdown and for handling peak loads.

Extensive revamping of oil-switch equipment is another of the items in the 1928 budget. Besides all this, four new substations will be built and additions made to existing stations.

Norris Muscle Shoals Bill Reported to Senate

Calls for Government Operation and Use of Revenue for Fertilizer Manufacture—Representatives Madden and Morin's Measures Before House Committee

SENATOR NORRIS' resolution calling for federal operation of the government's Muscle Shoals power plant and distribution equitably among the states within transmission distance of energy generated there was reported favorably by the Senate committee on agriculture on Wednesday by a vote of eleven to four. The resolution authorizes the government to operate the plant for ten years and the Secretary of War would contract for the sale of energy to states, counties, municipalities, corporations, partnerships or individuals for terms not exceeding ten years beginning Jan. 1, 1929.

The net proceeds from the sale of energy would be set aside for developing, manufacturing and introducing improved fertilizers and fertilizer practices with a view to reducing the cost and increasing the efficiency and use of fertilizers on American soils. The bill would also authorize the Secretary of Agriculture, within the limits of appropriations made by Congress from such special fund or from the Treasury, to construct and operate fertilizer experimental or production plants anywhere in the United States, to contract with commercial producers for the production of fertilizers and to arrange with farm organizations for large-scale practical use of new forms of fertilizers. To enable the Secretary of Agriculture to carry out such program, the resolution carries an appropriation of $2,000,000. This measure will be opposed determinedly both on the floor of the Senate and in the House on the ground that it would be an entrance of the government into the power business.

In the House the military affairs committee has referred the administration's Muscle Shoals bill, introduced by Representative Madden of Illinois, to a sub-committee. Representatives of the American Cyanamid Company and the Air Nitrates Corporation were heard. The Madden bill, providing for the lease of the government's Muscle Shoals properties to the American Cyanamid Company, is still in controversy owing to the fact that President Bell of the company is not willing to make all of the concessions upon which the committee had insisted. The Madden bill has strong support in the House, but its lack of support in the Senate committee is thought to reflect a strong feeling in the Upper House against it.

Chairman Morin of Illinois issued a statement explaining the advantages as he saw them over previous measures of his compromise bill. Representative Morin's bill provides, he said, "for experimental operation on a commercial scale for the purposes of demonstration and experimental use of fertilizer products, looking to private development and operation of such an industry. Further, in view of the widespread insistence in the South that the power developed at Muscle Shoals not used in making fertilizer belongs to the public and should be equitably distributed, the proposed legislation provides for such distribution of the excess power, insuring, however, terms that will bring a reasonable return. Should it not be possible to do this, the proposition would be handled by the Secretary of War as at present and the power sold in the open market."

Secretary Work Opposed to Pittman on State Rights

Secretary of the Interior Work, in a letter to Senator Johnson made public Jan. 28, takes issue with the contention, made in connection with the proposed construction of the Boulder Canyon Dam and indorsed in October last at the Denver Colorado River conference at the instance of Senator Pittman of Nevada, that individual states are owners of the waters of interstate or other streams flowing through their borders and may impose taxes for the use of such waters.

Two New Steam Plants for Pacific Coast

Great Western Power to Build 35,000-Kw. Plant at San Francisco—Los Angeles Gas & Electric Adding Unit of Same Size

THE Great Western Power Company of California announces the acquisition of 35 acres of land in San Francisco as a site for a new steam plant. The initial capacity of this plant will be 35,000 kw., and it will be designed to burn oil as fuel. The plant will be equipped with 450-lb.-pressure boilers and will deliver energy at 60 cycles, 11,000 volts. It will double the company's present reserve steam supply for the San Francisco Bay region and will provide emergency service for the Great Western's extensive hydro-electric supply in this area. Work is to start at once, with completion expected next year. McClellan & Junkersfeld, New York, have been engaged to design and supervise construction of this station, which will cost approximately $4,000,000.

The Los Angeles Gas & Electric Corporation has begun the installation of a second generating unit of 35,000-kw. rating. The installation of this unit will double the present capacity of the Seal Beach plant, which will ultimately reach 210,000 kw. Three new 2,500-hp. boilers and 45,000 sq.ft. in condensers, together with the necessary pumps and switching apparatus, will be installed with the new generator, which is expected to be ready to operate about Aug. 1, 1928. When it is in operation the total present capacity of the two steam plants of Los Angeles Gas & Electric Corporation will be about 150,000 kw.

Ottawa Government Views St. Lawrence

International Aspect of River Development from Canadian Angle—Advisory Council Report—Opposition to Power Exportation Maintained

AN IMPORTANT phase of the St. Lawrence waterway question dealt with by the Canadian National Advisory Council at a conference held in Ottawa in January concerned exportation of power. While the deliberations were conducted in camera, it is understood that one or two members of the council favored the idea of power export, on the ground that it would be a lucrative source of revenue for the Dominion. The majority of the council, however, were strongly opposed, and it is expected that the report, as finally drafted, will simply commend the stand taken last session of Parliament by the government, when Premier Mackenzie King, during a long discussion on the proposed Carillon department, assured the Parliament that there would be no export of power sanctioned by the Dominion government without the consent of the provinces affected.

Encouragement to private capital to develop the power on the national section of the river, virtually all of which is in the Province of Quebec, and the stipulation that those private concerns assist financially in the deepening of that section of the river, and recommendation that early steps be taken to open negotiations with the United States for a treaty governing joint deepening of the international section of the river between Lake Ontario and Cornwall, are understood to be other salient features of the report, which will be made public during the session of Parliament. that has begun.

A delegation from the Ontario Associated Boards of Trade and Chambers of Commerce recently waited upon the Dominion government and urged the improvement of the St. Lawrence waterways and development of the water powers by public ownership so far as Ontario is concerned. Two resolutions were presented. The first stated that in the opinion of the delegation the transference of any of the interests of the people of Ontario in the water powers of the St. Lawrence to the control of private or corporate interests should not be permitted. The second urged the government to proceed without unnecessary delay to make appropriate arrangements for the early construction of the enlarged St. Lawrence waterway and for the development of hydro-electric power between Lake Ontario and Montreal.

Premier King observed that the matter of "appropriate arrangements" connoted negotiations with the United States. "What," he asked, "is going to be the reaction on the public mind of Canada the minute the government begins to negotiate with the United States? Are the bodies that are now asking for the waterway going to back up the government?" Brig-Gen. C. M. Mitchell, who is a member of the Joint Engineering Board, replied that he thought so. No one could imagine for a moment that Canada could proceed without negotiations with the United States with regard to that part of the project which involved the two countries, he said. It was also felt, he added, that Canada ought not to export any power.

A Canadian newspaper report says that Montreal and Toronto financiers are prepared to install 13 miles of waterway in the St. Lawrence River between Lachine and Cornwall without cost to the government and develop eventually 2,000,000 hp. at this point, beginning with 300,000 hp. for which chemical and metallurgical works are ready to contract. According to the paper, the whole head of 80 ft. will be used and three sites developed, with power houses on the south shore opposite Lachine, which is virtually a suburb of Montreal. The syndicate behind the plan is said to have control of the Beauharnois Light, Heat & Power Company, of which R. O. Sweezy is president, and already to possess power rights on the St. Lawrence.

State Politics and Utility Companies

Massachusetts Votes Down Bill to Abolish Commission Jurisdiction —Gubernatorial Candidates in Ohio and Indiana Criticise State Regulation—Movements Elsewhere

A MOTION in the Massachusetts Legislature by Representative Twohig of Boston in favor of transferring to that body the powers of the Department of Public Utilities in connection with the supervision of public service corporations was defeated by 67 to 37. Several members of the Legislature attacked both the utility companies and the commission.

With the spring primaries in Indiana impending, the utility companies in that state are beginning to take an interest in the views of candidates, particularly those who are in the field for Governor and the Legislature. The primary interest of the utilities, naturally, is concerning the retention or abolition of the Indiana Public Service Commission and laws directly affecting taxation. Two well-known politicians are in the field for nomination as Governor both of whom are opposed to the present utility laws. Frank Baker, an Indianapolis attorney, who is a candidate on the Democratic ticket, makes the statement that he favors the abolition of the Public Service Commission. Alvah J. Rucker, recently corporation counsel for Indianapolis, a candidate on the Republican ticket, believes the utility regulation laws should be so changed that the municipalities will have more to say than at present. While corporation counsel he charged that the utility interests of Indiana had donated thousands of dollars to the campaign fund of the present Governor in order to influence his commission appointments.

Opposed Viewpoints in Ohio

Attorney-General Edward C. Turner of Ohio, a critic of public utilities, has announced his candidacy for the office of Governor, with the utility question as his chief issue. Mr. Turner has made a number of addresses in recent months in which he denounced Ohio public utilities as dealing unfairly with the public and uniting with other interests for the purpose of influencing the Legislature. He has also criticised the Ohio Public Utility Commission, charging that it is a poor safeguard.

"Rate making," Mr. Turner says, "is primarily an economic, not a political problem, and that is the crux of the whole matter. Our public utility commissioners are composed almost exclusively of men appointed for political, or sometimes personal, reasons. There are not many real economists among them. They may desire to do the right thing, but how can they answer the arguments of the able and resourceful lawyers whom the great corporations seeking franchises or increased rates can hire? What do they know about basic costs of production of public utility products or service or fair valuations of great corporation properties?" Mr. Turner maintains that service to be rendered and rates to be charged by a public utility corporation should be made the subject of a definite contract with provision for price changes in accordance with fluctuations in tax and interest rates and cost of labor and material. At present, he says, there is an overemphasis on reproduction cost as a rate base.

Governor Donahey, on the other hand, says that in Ohio regulation of utilities is a success. "We do not need any aid in this respect from the federal government," he declares, in commenting on the proposed Senatorial investigation of utility companies. "The sale of utility securities, like that of any other securities, is under state control. But, regardless of financial operations in utility securities, consumers' interests are protected, for the companies' earnings are restricted to a fair return on the value of the property used and useful for serving the public. Ohio stands firmly on the principle of state's rights and will resent any movement on the part of Congress to centralize the regulation of public utilities by the federal government."

William Tudor Gardiner, candidate for the Republican nomination for Governor of Maine, advocates leaving the question of power exportation to the people by means of a referendum vote. If there is a surplus of power after the demand for electrical energy in Maine is satisfied, Mr. Gardiner thinks that the power should be sold in any outside

market, subject to recall when needed. The Maine Public Service Commission could be called upon to determine what is surplus power.

A joint resolution asking that the International Joint Commission refuse permission for the construction of dams on the Minnesota-Ontario boundary has been introduced in the Wisconsin State Senate by Walter S. Goodland of Racine. The resolution asks that the permission be refused because the proposed dams would destroy the beauty and attractiveness of the boundary lakes.

The question of public ownership and operation of hydro-electric utilities will be before the voters of Oregon again at the next general election if the plans of the Co-operative Berry Growers' Association materialize. Despite the fact that the Oregon electorate declined to sanction a similar proposal by a vote of 147,092 to 35,314, the members of the fruit organization are seeking to arouse interest in an initiative petition which will again place the question before the people. Advocates of the plan propose to frame an amendment which will commit the state to a policy of developing local water-power resources and selling energy to the public at 10 per cent above the actual cost of production.

Reduced Rate Schedules and New Methods in Indiana

Twenty-five cities and towns in Indiana served by the Interstate Public Service Company are affected by a new optional electric rate schedule on all domestic service, including lighting, cooking, heating, refrigeration, water pumps and oil-burning appliances, which has been filed with the Indiana Public Service Commission. The new schedules provide for lower rates for domestic use in cases where additional equipment for the home, such as cooking and refrigeration, is used in connection with domestic lighting. Cities and towns affected by the new rates include Bedford, French Lick and West Baden.

Reductions in electric rates at Michigan City and six smaller places are provided in new optional rate schedules submitted by the Northern Indiana Public Service Company and approved by the commission. Rates included in the new schedule in most places range from 7 cents net down to 2½ cents per kilowatt-hour, with a meter charge of $1. A 4-cent rate for cooking and refrigeration is included.

Continuance until April or May of the present Huntington rate schedules has been asked by the Northern Indiana Power Company. The Northern Indiana Power Company, a subsidiary of the Central Indiana Power Company, is one of several Insull electric utilities in Indiana experimenting with rate charges based on the number of electrically connected rooms in a house. Some consumers at Huntington are seeking to stop the experiments, and the commission has set Jan. 19 as the date of the hearing.

Permits Asked for Chattahoochee and Western Rivers

Application to the Federal Power Commission has been made by B. H. Hardaway, J. Smith Lanier and Frederick H. McDonald for a preliminary permit for a power project on the Chattahoochee River, in Chambers County, Ala., and Troup and Heard Counties, Ga., near West Point, Ga. The applicants contemplate construction of one or more dams across the Chattahoochee at the Adamson or Wehadke dam sites, with a head of about 70 ft. and an initial installation of 12,000 hp. to 24,000 hp. of electrical machinery. The developed power will be utilized for public utility purposes. The applicants state that such a development will also aid flood control and afford transportation facilities by water to the town of Franklin, Ga., now 14 miles from railroad connections.

The Mount Baker Development Company has applied for a license for a partly constructed project on Bagley Creek, Wash., within the Mount Baker National Forest, 95 miles from Seattle. A concrete-arch dam 16 ft. high and 64 ft. long, creating a reservoir of 9½ acres in area, provides water for operation of 132 hp. in installed capacity.

The city of Milton, Ore., has applied to the commission for a preliminary permit covering a project on the South Fork of the Walla Walla River, in Umatilla County, Ore. It is planned to construct a power house just above the intake of the present plant and divert water to it from four miles upstream. This diversion will eventually be extended to the tailrace of the power house of the Pacific Power & Light Company. Another power house is to be constructed above the intake of the Pacific Power & Light power house which will furnish water for a proposed reservoir on the South Fork of the Walla Walla River. The power capacity of the first unit will be 1,150 hp.

L. B. Rouse of Pine Grove, Calif., has applied for a license covering a project on the Middle Fork of the Mokelumne River, Calif. This application is in conflict with a larger project of J. W. Preston, Jr.

Citizens to Study Great Falls of Potomac Plans

Appointment of a committee to study the relative scenic and utilitarian values of the Great Falls and Gorge of the Potomac River, use of which for hydro-electric projects is opposed by the National Capital Park and Planning Commission and various civic organizations of the District of Columbia, is announced by Major Brehon Somervell, United States Army engineer, to whom the applications of Stineman & Quick, Baltimore; the Potomac River Corporation and the South Branch Power Company for permits to develop this section of the Potomac were referred by the Federal Power Commission.

The committee will consist of Capt. H. O. Oram, Corps of Engineers; Charles W. Eliot 3d, city planner, National Capital Park and Planning Commission; C. A. Peters, engineer, office of Public Buildings and Public Parks; Dr. A. Eugene Baker, member Westchester Park Commission, New York, and Addison Flurnoy, Washington, landscape architect.

Artistic Lighting Association at Cleveland

The first day of the annual meeting and convention of the Artistic Lighting Equipment Association and a meeting of the Illuminating Glassware Guild at the Hotel Winton, Cleveland, Jan. 25 to 28, saw the registration of two hundred manufacturers and dealers. Of particular interest at this meeting was the proposed sales promotion and refixturing campaign, the details of which were outlined by G. P. Rogers on Friday morning. This campaign contemplates the adoption of a slogan and emblem by all members of the Artistic Lighting Equipment Association. This is to be popularized by means of an emblem tag attached to fixtures and is to be advertised locally by dealers and through the trade press by manufacturers and jobbers. A comprehensive plan of direct-by-mail folders, newspaper advertisements and publicity on adequate lighting is to be made a part of the campaign. General business sessions of the lamp and lighting equipment manufacturers were held on Thursday and Friday, with the annual dinner dance on Thursday evening.

Northwest Inspectors Favor International Association

A determination to continue to strive for the formation of an international association and to continue to co-operate with the electrical committee of the National Fire Protection Association, through its field secretary, as a means of exerting the co-ordinated effort necessary to an adequate revision of the National Electrical Code was the keynote of the third annual convention of the Northwest Association of Electrical Inspectors, which opened on Jan. 26 at Seattle. Eighty members registered.

The efforts to affiliate the sectional inspectors' associations into a nation-wide group were described in a progress report by F. D. Weber, secretary of the Northwest association and its representative in the national conference. In his annual message President H. S. Jenkins, chief electrical inspector for Bellingham, Wash., stressed the necessity of attaining safety through intelligent code making and administration without raising the standards to a point where the cost would act as a deterrent.

Speakers at the sessions included C. R. Welborn, Underwriters' Laboratories, Chicago; W. A. Groce, Olympia, and William Meacham, a Seattle contractor, who insisted that local regulations should be in addition to and not in modification of the national code.

Electrification, Welding and X-Ray Uses

These, with an Address by C. F. Hirshfeld on Economic Aspects of Engineering Advance, Are Features of the Michigan Engineering Conference

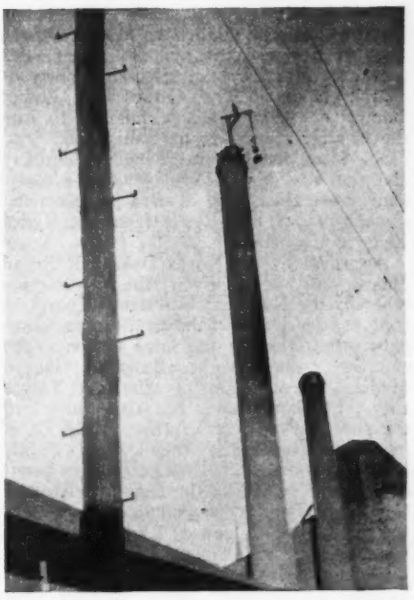
AT THE third annual conference of Michigan technical men, held in Detroit, Jan. 27 and 28, several addresses of special interest to electrical engineers were made. W. N. Vandersluis, electrical engineer for the Illinois Central Railroad, stated that during the first full year of electric operation his road recorded a 20 per cent increase in passenger traffic over the previous year of steam operation. The constant improvement in economy in the generation of electric power by central stations makes electrification of steam railroads increasingly attractive, he asserted; further, the business of the railroad is transportation, and power generation may well be left to the power companies where practicable. One of the advantages of electrification, he pointed out, is the elimination of fuel and water stations and the release of large numbers of coal cars for commercial service. The Chicago, Milwaukee & St. Paul found that 12 per cent of the power output of its substations is returned with regenerative braking. However, Mr. Vandersluis concluded, it looks as though it would be a long time before a uniform electrical system for railroad electrification is evolved in the United States.

According to William Spraragen, secretary American Welding Society, who was another of the speakers, there is great need for recognition of the fact that best results are never obtained by welding a part or a structure designed to be riveted. There is an enormous field for the application of automatic electric welding, which is not only a great labor saver but produces a more uniform product by the accurate control of variables. Electric spot welding has come into wide use in automobile body fabrication.

Prof. George L. Clark of the University of Illinois showed that the X-ray is an engineering tool that has been put to use in inspecting metal castings for hidden flaws, in testing welds for soundness, in the inspection of insulated wire, and in locating wires and pipes hidden behind walls. The hysteresis characteristic of silicon steels may be indicated with the X-ray.

The economic consequences of the revolutionary improvements that research and engineering have made in industry were discussed by C. F. Hirshfeld, chief of research of the Detroit Edison Company. Had it been looked forward to years ago, a large increase in production per unit of time, labor and investment would have seemed to herald disaster to the law of supply and demand. What actually happened was that the consumer, who is also the producer, received increases in real wages, so that he is enabled to buy more, and thus the demand for manufactured goods has kept pace with the increase in production. It is generally said, Mr. Hirshfeld remarked, that American prosperity follows from the large amounts of mechanical and electrical power placed in the hands of our workers. It is an error, however, not to include the effects of improved organization, improved treatment of wage earners, increased efficiency of executive forces and increased output per unit of invested and of working capital.

Serving Luncheon on Top of a Power-Plant Stack



SOMETHING new in the way of pleasing customers was recently thought of by the Jordan (Minn.) Electric Light & Heating Company. One hundred and twenty citizens of that place made an ascent to the top of the smokestack of the company's plant, which is 108 ft. high, 4 ft. in diameter and built of brick and concrete. Of these climbers seventeen were women. About fifty persons were served with luncheon on top of the stack, six at a time, according to S. L. Sly, manager of the plant. The luncheon, which was cooked electrically, can be seen in the picture as it approaches the reach of the guests.

The Jordan plant furnishes electric light and power service to the city and district steam heat to 64 buildings, so that the stack is the only one in the place, which in consequence boasts a sky almost clear.

Build 946 Miles of Line in North Dakota in 1927

North Dakota's seven major electric light and power companies had 2,846 miles of transmission lines either constructed or approved on Dec. 1, 1927, according to a report just made public by the North Dakota Board of Railroad Commissioners. The seven companies are the Otter Tail Power, the Northern States Power, the Montana-Dakota Power, the Hughes Electric, the Northern Power & Light, the Northern Utilities Corporation and the Interstate Power Company. During 1927 four of these companies constructed 946 miles of transmission lines. The policy of merging small community units, thus adding a total of 53 towns to their service, was continued by the four companies.

The report shows that the total mileage of the Otter Tail Power Company's transmission lines in North Dakota, either constructed or approved, is 1,562 miles; of the Northern States Power Company, 110 miles of the Montana-Dakota Power Company, 477 miles; of the Hughes Electric Company, 307 miles; of the Northern Power & Light Company, 276 miles; of the Northern Utilities Corporation, 82 miles, and of the Interstate Power 25 miles. During 1927 the Montana-Dakota Power added 53 miles of 13,200-volt lines, the Northern Power & Light 157 miles at 22,000 volts, the Hughes Electric 46.5 miles at 12,300 volts, the Otter Tail Power 410 miles at 38,100 volts, 115 miles at 6,600 volts, and 165 miles at 13,200 volts. Thirty towns were added to the Otter Tail Power Company system, eleven to the Montana-Dakota Power system, seven to the Hughes Electric system, and five to the Northern Power & Light system.

Conowingo Dam Closed

Formation of Nine-Thousand-Acre Lake Begins as Ancient Village Disappears from Maryland Map—Power to Be Transmitted in Spring

MANY spectators gathered near the deserted site of the 150-year-old village of Conowingo, Md., on Wednesday, Jan. 18, to watch the water gradually accumulate in the 9,000-acre reservoir which became a fact when the last eight gates of the great dam were closed early that morning. The new lake will extend 13 miles up the river into Pennsylvania. Its depth will vary from 100 ft. at the dam down to 40 ft.

Work on the Philadelphia Electric Company's great hydro-electric plant began in March, 1926. From that time until a few weeks ago from 2,000 to 3,500 men were employed on the task. With favorable conditions and organizations, the fifty-two-million-dollar project has been finished several months ahead of time. The construction required the excavation of 400,000 cu.yd. of rock. More than 750,000 cu.yd. of concrete were required on the work.

The first three of the seven generators are to be installed at once, and it may be possible to transmit power to Philadelphia in three months' time. In the fall, when the seven generators are completed, Conowingo will be second only to Niagara Falls among the hydro-electric plants of the country. It will then have a capacity of 378,000 hp., outranking the existing installation at Muscle Shoals and far surpassing such plants as those at Holtwood and Keokuk. The eventual capacity of Conowingo, with eleven generators, will be 594,000 hp.

Purchases and Mergers

Iowa Public Service Company, Along with Sioux City Gas & Electric, Goes to American Electric Power—Bankers Buy Central West Public Service —Many Other Transactions

PURCHASE by the Iowa Public Service Company of the Sioux City Gas & Electric Company from the United Gas Improvement Company of Philadelphia is reported. This sale, which is connected with the U.G.I.-American Electric Power transaction recorded last week (page 220), includes the new Big Sioux power plant in North Riverside, which cost $3,500,000 and upon which a million-dollar addition is under way, and several hundred miles of high-tension transmission lines in northwest Iowa, serving nearly a hundred towns and cities in the Sioux City district, as well as the Sioux City Service Company. The deal is reported to have involved nearly $10,000,000. The United Gas Improvement Company had been interested in the Sioux City utilities since 1889. C. I. Crippen and H. A. Clarke, vice-presidents of the American Electric Power Corporation, and Don Stearns, president of the Iowa Public Service Company, announce that the actual transfer of properties will probably be accomplished in 30 days. W. J. Bertke, president of the Sioux City Gas & Electric Company, said that the American Electric Power Corporation will acquire the interests of the United Gas Improvement Company in the Iowa Public Service Company in exchange for the holdings of the American Electric Power Corporation in the Delaware Electric Power Company. This arrangement, he explained, had been promoted by the desire of the United Gas Improvement Company to concentrate its holdings in the East and by the desire of the American Electric Power Corporation to acquire a strong utility company in the Middle West. General offices of the Iowa Public Service will be continued in Fort Dodge, Iowa, and Don Stearns will continue as president.

Announcement is made of the purchase by A. B. Leach & Company and I. M. Porter & Company of New York and Chicago of the stock holdings of Walter M. Albertson, president, and George M. Kaltwelt, vice-president, in the Central West Public Service Company and subsidiaries for a consideration of $3,000,000. The Central West Company serves 147 communities in Nebraska, Iowa, North and South Dakota and Minnesota, with headquarters at Omaha.

Negotiations have just been concluded by which the New England Public Service Company, as already forecast, acquires the Utilities Company of Meredith, N. H. The purchase, which follows that of the Franklin (N. H.) Light & Power Company, may, it is rumored, be followed by acquisition of additional rights in and around Plymouth, N. H., including the plant of the Parker-Young Company. The Utilities Company has a dam on the Pemigewasset River near Bristol, N. H., and supplies power and light to a population of approximately 70,000.

Arthur S. Dewing of Boston has obtained control of the Goodrich Falls (N. H.) Electric Light & Power Company. He now controls also, it is understood, the Meredith Electric Company, the Baker River Light & Power Company, the Hill Light & Power Company, the East Andover Light & Power Company and the Alton Electric Light & Power Company, all in New Hampshire. Water rights are included.

Permission to purchase the electric distribution systems at Hannaford and Cooperstown has been given by the North Dakota Railroad Board to the Northern Light & Power Company. Both properties now are owned by the Electric Construction Company. The Otter Tail Power Company has received permission to buy the electric properties at Sanish and Van Hook from the General Service Company and the Van Hook Light & Power Company respectively and also to purchase the electric property at Ryder from the Ryder Electric Company.

Approval by the North Dakota Railroad Board has been given the transaction whereby the Northern Utilities Corporation sold to the Dakota Public Service Company, controlled by the same interests, the electric properties at Buffalo, Gackle, Medina, Streeter, Starkweather and Tower City. The commission has also authorized the purchase of electric properties at Bowman and Reeder by the Dakota Public Service Company. Both of these properties were owned by the Bowman Electric Company. The former company has bought the Hettinger Electric Light & Power Company and the Alpena (S. D.) plant.

Announcement has been made that Baker, Young & Company have acquired the control of the Page Power and Massanutten Power companies, Luray, Va. The Page Power Company recently completed a hydro-electric dam on the Shenandoah River. The Massanutten Power Company, a subsidiary of the Page Power, was the result of a purchase of municipal plants.

Merger of the Saranac River Power Corporation and the Saranac Utilities, Inc., just chartered, is in prospect, according to T. Harvey Ferris of Utica, N. Y. If the merger is permitted, the company will own 8,000 hp., of which 7,000 hp. is developed.

By a vote of 244 to 168 the village of Sargent, Neb., has rejected a proposal to sell the municipally owned plant to the Nebraska Electric Power Company.

The Northwestern Utilities Corporation of Minneapolis has completed the purchase of the Mapleton (Minn.) Electric Company.

Jolley, Iowa, will sell its municipal electric system to the Iowa Public Service Company if the voters approve an agreement entered into by the Town Council.

Sale of the municipally owned electric system at Bagley, Iowa, to the Iowa Railway & Light Corporation has been authorized at a special election.

The Adrian, Burnside, Colusa & Ferris Light & Power Company of Ferris, Ill., has applied to the Illinois Commerce Commission for permission to sell its property to the Central Illinois Public Service Company.

The Illinois Public Utility Company has been authorized to purchase the Heyworth Electric Light & Power Company, serving Heyworth, Randolph and Wapella, for $55,000 and to construct and operate a 13,000-volt transmission line between these places.

Elsberry, Mo., has sold its municipal electric plant to the Missouri Edison Company for $55,000.

The Federal Public Utilities Company of Chicago has sold the Waynesboro (Miss.) ice and light plant to the Central States Power & Light Company, with headquarters in Davenport, Iowa. The plant was purchased by the Chicago concern several months ago for about $72,000. Included in the same deal were the light and power plants in four other Mississippi towns—Lucedale, Leaksville, New Augusta and Brandon—and in Citronelle, Ala.

Purchase of the Santa Cruz County Utilities of Boulder Creek, Cal., and the Capitola Company of Capitola, Cal., by the Public Utilities California Corporation, a Foshay organization, has been approved by the California Railroad Commission. The newly acquired properties supply electric power and water to a territory about 14 miles from Santa Cruz.

What seem to be well-authenticated reports from Phoenix, Ariz., indicate that the Arizona Power Company, an independent utility, may soon become a subsidiary of one of several large holding companies interested in Arizona utility properties.

Sale of the Gallup (N. M.) Electric Company to the International Utilities Company of New York is announced. A previous deal with the Texas-Louisiana Power Company fell through.

The merger of the Kentucky Power Company with the United Public Service Company of Chicago, noted last week, has led to speculation in Cincinnati as to the possibility of future competition between Kentucky and Ohio utilities. The Kentucky company supplies power to Augusta and 37 other places in Kentucky and has wires covering fourteen counties and reaching as far west as California, Ky., about 25 miles from Cincinnati.

Confusion caused by newspaper announcements is cleared up by an official statement from George N. Tidd, president of the American Gas & Electric Company, that, while retaining the electric light and power business in Roanoke and Lynchburg, Va., and the Lynchburg gas plant, which have for some time been operated by the Appalachian Electric Power Company, the American Gas & Electric has sold the Roanoke Railway & Electric Company, the Roanoke Traction & Light Company and the Lynchburg Traction & Light Company, operating railway and bus lines. The new owner is the Central Public Service Company, Chicago, which also recently purchased the Rockford Electric Company and various railway and bus lines from the American Gas & Electric Company.

Official announcement is made at Montreal of a long-looked-for absorption of the St. Maurice Power by the Shawinigan Water & Power Company, the parent company. The subsidiary will be merged into the Shawinigan on a basis of two shares of Shawinigan for one share of St. Maurice. with the alternative of $175 per share in cash offered to St. Maurice stockholders.

Making its first entry into the northern Canadian field, the Mid-West Utilities, Ltd., a subsidiary of the International Utilities Corporation, has purchased the municipal electric plant at Grande Prairie, Alberta, for $13,500.

The International Power & Paper Company of Newfoundland, Ltd., a subsidiary of the International Paper Company, has acquired the property and assets of the Newfoundland Power & Paper Company, Ltd. The properties include a hydro-electric plant generating 98,000 continuous horsepower. The controlling interest in the Newfoundland Power & Paper Company was owned by English interests.

Jersey City Is Site of New Switching Station

Public Service Production Company Builds Third in Series of Such Plants, Hudson Following Trenton and Athenia—Built in Seven Months

THE third of a series of high-voltage distributing centers for electrical energy was connected to the lines of the Public Service Electric & Gas Company at Jersey City, N. J., on Jan. 28. This station, known as the Hudson switching station, is supplied with power at 132 kv. from a two-circuit tower line connecting near by to the 132-kv. link between the Marion generating station and the Kearny and Essex stations.

The Hudson switching station, designed and constructed by the Public Service Production Company, is somewhat similar in design to the Trenton and Athenia stations, respectively placed in operation about four months and twelve months previously. Four 15,000-kva., single-phase self-cooled transformers, one a spare, are installed for stepping down the voltage to 26.4 kv. for distribution of power to the Hudson and Bergen divisions of the operating company. All of the primary disconnecting switches necessary for the operation of the bank of transformers in the initial installation are motor-operated, as are the secondary transfer-bus switches, the switches of both voltages being the first in the Public Service system to place dependence upon high pressure rather than large area of contacts. Outdoor 26.4-kv. reactors are employed in the bus layout and represent the first installation on the company's lines of oil-immersed reactors. Owing to the switching station's proximity to the three large generating stations of the system, no provision has been made for the future installation of synchronous condensers on the tertiary windings of the main transformers.

Additional sources of power to the switching station are furnished by connections at 26.4 kv. from two 11,500-kva., three-phase transformers adjacent to the Marion station. At the switching-station end of these lines 26.4-kv. tap-changing voltage regulators are installed to facilitate handling of the three-cornered condition, viz., the step-up to 132 kv. from 13.2 kv. at the Marion generating station, the step-down from 132 kv. to 26.4 kv. at the Hudson switching station, and the step-up from 13.2 kv. to 26.4 kv. at Marion.

The actual construction of the switching station presented several unusual problems. The entire foundations are supported on piling, it having been necessary in some instances to drive a number of piles in close proximity in order to obtain sufficient support in the marshy soil. The presence of surface water made necessary the continuous operation of pumps and the temporary erection of earth dikes at certain edges of the property. Nevertheless, the date of the station's completion followed the date of ground breaking by only about seven months. A feature is the installation of a kenotron set for the testing of cable up to a direct-current voltage of 150 kv.

Briefer News

UPSTATE NEW YORK UTILITY CHANGES NAME.—The Depew & Lancaster (N. Y.) Light, Power & Conduit Company has filed a certificate changing its corporate name to the Western New York Gas & Electric Corporation.

ADDITIONAL 4,000-HP. GENERATOR FOR GOVERNMENT PLANT AT GUERNSEY, WYO.—A second 4,000-hp. generating unit was installed recently at the government's irrigation and power plant at Guernsey, Wyo., thus doubling its capacity. Enough water for two more such units is reported to be available at this site.

GEORGIA POWER COMPANY'S ENLARGED HEADQUARTERS.—Reconstruction of the office building of the Georgia Power Company in Atlanta by the addition of three floors and by improvements in the Walton Street annex, at a cost of $500,000, has recently been completed and gives the company 33,000 sq.ft. of floor space and modern quarters for its business offices and its display rooms.

NEW INTERSTATE LINE AUTHORIZED FOR NEW HAMPSHIRE COMPANY.—The Southern New Hampshire Hydro-Electric Company has received permission from the New Hampshire Public Service Commission to build a transmission line from Canaan, Vt., through Stewartstown, Colebrook, Columbia, Northumberland and Stratford to Lancaster, N. H. Work will be begun as soon as conditions are favorable.

HYDRO PLANT TO BE BUILT TO SERVE OREGON MINES.—Coming construction by Eastern capital of a hydro-electric system on Blue River, 45 miles east of the city of Eugene, Ore., has been announced by J. S. Miller, owner of mining properties in the district, who says that the energy generated will be used for the operation of a railway from Eugene to the mining property and also in the operation of mining machinery.

PROGRESS OF NORTHERN STATES POWER COMPANY.—Present indications are that the Northern States Power Company's 30,000-hp. hydro-electric station at Chippewa Falls, Wis., which is to operate synchronously with the 42,000-hp. Wissota hydro-electric station, 3 miles further up the Chippewa River, will be completed by September in accordance with the plans. The Northern States company has just replaced the steam ends of two 1,500-kw. turbine units in its steam plant at Fargo, N. D., with new equipment, thereby increasing their rating to 2,250 kw. each. Additional generating capacity at Grand Forks and Minot, N. D., has also been authorized, and plans have been approved for the construction of the 84-mile transmission line from Green Bay to Stevens Point, Wis., which is to interconnect the systems of the Wisconsin Public Service Corporation and the Wisconsin Valley Electric Company. This line will be of H-frame, wooden-pole construction and will operate at 110,000 volts. It will involve substation equipment at each end and will cost about $1,500,000.

NORTHWEST COMMERCIAL MEN TO MEET IN PORTLAND ON FEB. 20-21.—A meeting of the executive committee of the Commercial Section, Northwest Electric Light and Power Association, set the time for the midwinter meeting of the section as Feb. 20 and 21. Portland, Ore., will be the place. Reports of committees showed activity in the promotion of commercial cooking, merchandising, industrial heating, rural service, street and highway lighting and home and industrial illumination. Ten talks before business men's lighting clubs have been made already, out of thirty scheduled.

INTERNATIONAL WATER COMMISSION TO MEET AT EL PASO AND JUAREZ THIS MONTH.—The first joint meeting of the Mexican and American sections of the International Water Commission has been called to convene at El Paso, Tex., and Juarez, Mexico, on Feb. 27, the chairman of the American section of the commission, Dr. Elwood Mead, announces. The American commissioners appointed by the President are, as previously announced, Dr. Mead, Gen. Lansing H. Beach and W. E. Anderson. Miss M. A. Schnurr is secretary of the American section.

OKLAHOMA-KANSAS INTERCONNECTION.—The Empire District Electric Company is making rapid progress on construction of a frequency changer and turbine room at its Riverton (Kan.) steam plant. This is a part of a construction program which is expected by late spring of this year to involve an expenditure of approximately $1,100,000 and to bring transmission-line connections between the Riverton plant and the Neosho River plant of the Kansas Gas & Electric Company, southwest of Pittsburg, Kan. It will give all the Oklahoma towns on the lines of the company direct connection with these two Kansas power-generating plants.

SOUTH GEORGIA RATE REDUCTIONS.—The Georgia Public Service Commission has followed the investigation previously reported by ordering substantial rate reductions in all cities and towns in the state served by the Georgia Power & Light Company, which supplies Valdosta, Waycross, Bainbridge and other cities in south

Georgia. In the three cities named the new rates for residential and commercial lighting range from 11 cents for the first 40 kw.-hr. per month down to 5 cents for consumption over 1,000 kw.-hr. In Blackshear, Boston, Jessup, Waynesboro and other towns the new rates range from 12 cents to 6 cents. Rates for industrial service were also reduced in nearly every community served.

ARIZONA POWER COMPANY MAKES FIVE-YEAR CONTRACT WITH UNITED VERDE COPPER COMPANY.—Negotiations have just been concluded whereby the Arizona Power Company contracts to supply the United Verde Copper Company with its power requirements for five years from Oct. 1 last, according to B. M. Wotkyns, director of the Arizona company. The contract assures Arizona Power of a large and steady load from this one source. Another advantage accruing to the power company is that it is enabled to buy waste-heat power from the copper company on good terms for use during peak conditions. The copper company operates a large concentrating mill and copper smelter in connection with its mine.

ELECTRIC DEPARTMENT BUDGET OF NEW JERSEY PUBLIC SERVICE CALLS FOR $22,000,000.—Budgets for 1928 of the operating companies of the Public Service Corporation of New Jersey representing a total of approximately $37,000,000 have been approved. Of this sum more than $22,000,000 will be used by the electric department of the Public Service Electric & Gas Company, $7,000,000 being appropriated for interconnection and transmission projects, half of which is for the tri-company agreement to which the Pennsylvania Power & Light and the Philadelphia Electric are the other parties. The 40-acre Roseland switching station will cost between $5,000,000 and $6,000,000, and $700,000 is to be spent on a spare bank of transformers, consisting of three 15,000-kva. units, and other equipment at Kearny.

TWO NEBRASKA COMPANIES WILL PUSH RURAL SERVICE EVEN AT LOSS.—The Nebraska Power Company has provided in its 1928 budget more than a million dollars for reconstruction and extensions. A considerable portion of this will be expended in rural electrification, the company having just obtained authority from the State Railway Commission to construct a dozen transmission lines in the well-settled counties surrounding Omaha, where its plant is situated. In this section the company has bought a number of municipal plants, and it will make these the center of farm operations. A complete circuit will enable the routing of energy in either one of two directions. The company is offering to supply all equipment needed to reach each farmer, the service charge to be a sum equal to the interest on the investment plus the upkeep cost, after which electricity will be supplied at rates close to those prevailing in the cities. The Iowa-Nebraska Light & Power Company is planning developments along the same lines. Both companies are said to be prepared to lose some money in making the experiment, if necessary.

N. E. M. A. POLICIES DIVISION MEETING. — Business practices and business getting will be major subjects of discussion at the March 14-16 meeting of the Policies Division, National Electrical Manufacturers' Association, according to announcement by Vice-president Clarence L. Collens. The meeting will be held at the Edgewater Beach Hotel, Chicago. A meeting of the board of governors, at which President Gerard Swope will preside, is scheduled for Wednesday evening, March 14.

NEW INTERNATIONAL COMPANY TO SERVE BOTH SIDES OF THE RIO GRANDE.—Another utility company has been organized on the Lower Rio Grande border for the purpose of doing an international business. It is the Hidalgo Utilities Company and has a capital stock of $100,000. It will construct an electric power plant at Hidalgo and has obtained a concession from the Mexican government to build a wooden-pole transmission line to Reynosa, Mexico, and other towns in the State of Tamaulipas. The company will also serve Hidalgo and other towns on the American side of the river. A. Y. Baker of Edinburg, Tex., has been elected president.

UVALDE, TEX., BECOMES STRATEGIC POINT IN ELECTRIC SERVICE.—Uvalde, Tex., will soon be the hub of a transmission network connecting it with the Winter Garden district on the south, with San Antonio on the east and, from Del Rio, with the extensive system of high-tension lines in west Texas. Lines from the San Antonio Public Service Company and the West Texas Utilities Company will join the Central Power & Light Company's system at Uvalde, where the Central Power & Light Company is building a large substation. That company expects that a 132-kv. trunk line will be necessary eventually, into which the 66,000-volt system now under construction can be tied. Uvalde will be power headquarters for the Winter Garden district, the company says.

CLEVELAND ELECTRIC ILLUMINATING'S BIG 1928 BUDGET.—Announcement that the Cleveland Electric Illuminating Company would spend $9,800,000 in 1928 on additional facilities for providing the Greater Cleveland district with electric service was made at the recent annual meeting of stockholders. This is nearly $2,600,000 in excess of the sum similarly expended in 1927. Construction will include the installation of a 35,000-kw. turbo-generator with boilers and auxiliary equipment at Avon station, as already announced; a 132-kv. steel-tower transmission line to connect Avon station with Clinton substation, the million-dollar structure at West Ninety-fifth Street completed a year ago, and additions to that substation and to twenty others, besides additional underground lines and distribution lines.

LARGE ATTENDANCE AT SAN FRANCISCO ENGINEERING MEETINGS.—An unusually large attendance and keen interest in committee work featured the midwinter meeting of the Engineering Section of the Pacific Coast Electrical Association held in San Francisco, Jan. 11-12. At a luncheon meeting attended by 180 P. M. Downing, vice-president of the association, said that the ideal toward which the Engineering Section should work is to obtain the greatest possible number of kilowatt-hours per dollar of invested capital. Individual committee meetings were unusually well attended and all committees reported a most active year. An innovation was joint meetings of each committee with the accident prevention committee. In this way the latter committee was able to arouse the interest of all committee

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see ELECTRICAL WORLD for Jan. 7, page 80.]

American Institute of Electrical Engineers — Winter convention, New York, Feb. 13-16; St. Louis regional meeting, March 7-9; Baltimore regional meeting, April 17-19. F. L. Hutchinson, 33 West 39th St., New York.

Rocky Mountain Division, N.E.L.A.—Albuquerque, N. M., Feb. 14-16. O. A. Weller, 900 15th St., Denver.

Midwest Power Conference — Hotel Stevens, Chicago, Feb. 14-17. G. E. Pfisterer, 53 West Jackson Blvd., Chicago.

Iowa Power Conference—University of Iowa, Iowa City, Feb. 15 and 16. Joe Carmichael, Iowa Committee on Public Utility Information, 310 Crocker Bldg., Des Moines.

Northwest Electric Light and Power Association — Commercial Section, Portland, Ore., Feb. 20 and 21; Engineering Section, Spokane, Wash., March 8 and 9. Berkeley Snow, 1208 Spalding Building, Portland, Ore.

New Mexico Utilities Association—Albuquerque, N. M., Feb. 20-22. Arthur Prager, Albuquerque Gas & Electric Company, Albuquerque.

Oklahoma Utilities Association—Mayo Hotel, Tulsa, March 13-15. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association—Hotel Abraham Lincoln, March 14-15. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

National Electrical Manufacturers' Association—Policies Division, Edgewater Beach Hotel, Chicago, March 14-16. S. N. Clarkson, 420 Lexington Ave., New York.

International Association of Electrical Inspectors—Madison, Wis., March 17-18. W. Wilke, 4211 Eiring Place, Milwaukee.

Maryland Utilities Association—Emerson Hotel, Baltimore, March 23. G. S. Williams, 1005 Continental Bldg., Baltimore.

Southwestern Division, N.E.L.A. — Edgewater Gulf Hotel, Biloxi, Miss., April 3-5. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

members in accident prevention work, and through the presentation of papers on safety practice and methods and training of personnel many valuable ideas were brought out.

ANOTHER UNIT FOR MCCAMEY, TEX.—Another unit for the power plant of the Pecos Valley Power & Light Company, 10 miles west of McCamey, Tex., is under construction. It will have a capacity of 8,000 hp. and will bring the total rating of the plant to 24,000 hp. Power from this plant goes to the oil fields of west Texas as well as to towns which are within a radius of more than 100 miles.

OHIO POWER COMPANY'S BIGGEST UNIT TO GO IN AT PHILO THIS YEAR.—The Ohio Power Company has now 350 men at work on the construction of its 165,000-kw. unit at Philo. Thirty-four concrete caissons have been sunk to rock, 52 ft. below ground level. These caissons vary from 8 ft. to 22 ft. in diameter. All the steel columns for the superstructure will be supported by these caissons. Field work to date indicates that the new turbine will be ready to take the line load before the end of the year—perhaps by Nov. 1.

BACK RIVER POWER COMPANY LETS CONSTRUCTION CONTRACTS IN QUEBEC PROVINCE.—Several contracts have been awarded on the power development of the Back River Power Company near Montreal, a project which will involve a total expenditure of $8,000,000. The operating company is to be the Montreal Island Power Company, Ltd., incorporated in 1927. This company has a contract with Montreal Light, Heat & Power Consolidated under which the latter will purchase all the power for a period of 30 years, with opportunity of renewal for 30 years more. The site is capable of developing 65,000 hp. under a 26-ft. head, and it is expected that the initial 40,000 hp. will be available for delivery by the end of 1929. The power plant will consist of a number of units of 7,500 hp. each. Eventual installation may reach 92,000 hp.

LOS ANGELES RIVALS BOTH TO CUT RATES AGAIN.—The Bureau of Power and Light of Los Angeles has been authorized by a resolution passed by the Board of Water and Power Commissioners to reduce its present rates for electricity approximately 10 per cent. The reductions are to be put into effect beginning July 1 of this year, when the lighting rate will be reduced from 5 cents to 4.5 cents per kilowatt-hour and the maximum power rate from 4.5 cents to 4 cents. Last July the bureau cut its lighting rate from 5.6 cents to 5 cents and its maximum power rate from 5 cents to 4.5 cents. Coincident with the announcement of the reduced rates on the part of the municipal department, Addison B. Day, executive vice-president and general manager of the Los Angeles Gas & Electric Corporation, announced that his organization would make a similar move.

Recent Court Decisions

COMMISSION CANNOT PROHIBIT UTILITY FROM KEEPING SECOND SET OF FIXED-CAPITAL ACCOUNTS IN ITS OWN WAY.—While the New Jersey Board of Public Utility Commissioners could order the Passaic Consolidated Water Company to keep its fixed-capital accounts in a way approved by the commission, it could not forbid the company to keep in addition another set in which its own desires could be followed, said the Supreme Court of New Jersey in deciding for the plaintiff in a suit brought by the water company against the commission. (139 At. 324.)*

COMMISSIONS MUST BE GOVERNED BY PRINCIPLES OF COMMON LAW.—"It is elementary," declared the Appellate Court of Indiana in reversing a verdict for damages (Puckett vs. Terre Haute, Indianapolis & Eastern Traction Company), in which the headlighting equipment of an interurban car as prescribed by the Public Service Commission was concerned, "that boards and commissions in exercising power conferred upon them by statute must be governed by the rules and principles of common law. These rules and principles require that such power shall always be exercised in a reasonable manner. If not so exercised, any rule, order or ordinance contrary thereto will be by the courts declared void." (158 N.E. 639.)

ENTRY OF OCCUPIED FIELD PERMITTED IN NORTH DAKOTA. — M. A. Erickson of Rugby, N. D., has won in the Supreme Court of that state the suit brought against him to halt the construction of a power plant at Kenmare (ELECTRICAL WORLD, Dec. 3, page 1168) and has announced that he will proceed with the building early next spring. The State Railroad Commission held that Erickson should be enjoined from constructing the plant since he had not obtained a certificate of convenience and necessity as required by the 1927 law, which became effective on July 1. Erickson maintained that since he obtained a franchise from the city of Kenmare on June 6 the law did not apply. Erickson will now institute court action to halt the Montana-Dakota Power Company, now furnishing electrical service at Kenmare, from further operations in that city.

JACKSONVILLE'S RIGHT TO WIRE DOMESTIC ELECTRIC EQUIPMENT AGAIN SUSTAINED.—The Circuit Court at Jacksonville, Fla., has handed down a decision to the effect that the city has the proprietary right to engage in the business of making wiring connections and installations for electric stoves and other equipment. Suit was brought several months ago (ELECTRICAL WORLD, Oct. 8, page 756) by Edward Hamler, a taxpayer, to restrain the city from doing such work, the plaintiff contending that the city was stepping outside its province in doing the wiring work and that the work was being done at less than cost on the theory that the city would profit through the increased use of electricity. It was also contended that electrical dealers were being injured and that the interests of the public were jeopardized because any losses sustained by the city would have to be paid from public funds. Application for a temporary injunction was denied last November, and the sustaining of the demurrer settles the case as far as the Circuit Court is concerned.

PRIVATE COMPANY BARRED FROM SUPPLYING ALTERNATING-CURRENT ENERGY IN CITY WITH MUNICIPAL DIRECT-CURRENT SUPPLY.—Decision for the town of Ackley, Iowa, in a suit to uphold a temporary injunction procured by the town to halt the Central States Electric Company's installation of wires through Ackley to reach a creamery desirous of alternating-current service has been given in the Iowa Supreme Court. The manager of the creamery claimed that the direct-current service of the municipal plant was unsuitable to his needs and contracted with the Central States company, from which the town, which is to change over to alternating service, will now seek damages.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

PROFIT BY CONSTRUCTION COMPANY IN SALE OF ITS PRODUCT TO ALLIED UTILITY COMPANY CONDEMNED.—The California Railroad Commission has laid down the principle that it will not permit a corporation owning all of the stock of a public utility under its jurisdiction to exact a profit at the expense of the public utility and to capitalize such profit in securities issued by authority of the Railroad Commission. The commission took this action in a supplemental order on the application of the Pickwick Stages System for authority to use the proceeds from the sale of stock and certificates issued by it to buy rolling stock owned by the Pickwick Corporation, a company which owns all of the outstanding stock of Pickwick Stages System, the operating utility. It was brought out that the Pickwick Corporation proposed to charge a profit on the equipment constructed for its own use in the amount of $8,910. In passing upon the application the commission said: "We do not look with favor on the practice of permitting a construction company to profit at the expense of a public utility when the construction company controls the public utility or is owned or controlled by the same interests which own or control the utility."

UNUSED PROPERTY IN VALUATION.—The rate base of the Lakewood Water Company has been modified on rehearing by the New Jersey Board of Public Utility Commissioners, which sustained a contention that in making deductions for property not used and useful the amount deducted had been only the basic figures representing values of the items in question and that additions for intangibles such as "going concern" value had not also been deducted. On the other hand, the commission refused to sustain a contention that part of a building used jointly by several companies as a shop for the maintenance and repair of gas, electric and water meters should be omitted from the rate base because the water company involved did not own the building. Likewise, the commission refused to exclude from the rate base an amount representing the value of excess land not used by the company and not easily salable, but necessarily acquired with other land which was necessary for the right-of-way.

News About Men of the Industry

Drexler Acting Manager of Virginia Utility

Norman E. Drexler, since 1916 chief engineer of the Newport News & Hampton Railway, Gas & Electric Company, now the Virginia Public Service Company, has been named acting manager of that utility to supervise the work formerly directed by C. D. Porter, who has transferred his interests to Omaha.

Mr. Drexler became assistant engineer of the Newport News company in 1912 and after serving in that capacity for two years he was made master mechanic and subsequently assistant superintendent of transportation. It was in 1916 that he was appointed chief engineer. As announced in the Jan. 28 issue of ELECTRICAL WORLD, Mr. Porter, vice-president and general manager of the Virginia Public Service Company, resigned to become vice-president and general manager of the Omaha & Council Bluffs Street Railway Company.

E. N. HENRY, assistant superintendent of the northern division of the Alabama Power Company, Huntsville, has been transferred to Demopolis in the capacity of district superintendent.

FRANK TIBBALS has been elected secretary and treasurer of the Westfield Power Company, Westfield, Mass. Mr. Tibbals is also a member of the board of directors.

H. T. ASBURY, manager of the McAlester division of the Southwest Power Company, has been transferred to Fayetteville, Ark., where he will have charge of the Fayetteville division.

J. E. EVERSON, formerly electrical engineer of the Sioux City (Iowa) Gas & Electric Company, has been promoted to the position of general superintendent with general supervision of electric and gas production and distribution.

B. E. WALTZ, vice-president of the United Public Service Company of Chicago, will leave that city this month to take active charge of the Kentucky Power Company's plants recently acquired by the United Public Service Company.

W. L. CARR has been appointed supervisor of electric metering for the New York Power & Light Corporation, Albany. Mr. Carr's new duties will include the selection of types of electric meters, installation methods and testing.

OLIVER A. CHURCH has been appointed district manager of the Batavia (N. Y.) district of the Niagara, Lockport & Ontario Power Company and GLENN W. IDE has been named district manager at Medina. Mr. Church was formerly construction superintendent at Batavia. His promotion follows the company's change in name from the Western New York Utilities Company to the Niagara, Lockport & Ontario Power Company. He is replacing H. K. Stein, formerly district manager at Batavia, who recently resigned.

WILLIAM FOSTER has been appointed general superintendent of aerial and underground construction of the Philadelphia Electric Company.

OWEN D. YOUNG, chairman of the board of directors of the General Electric Company, was elected a member of the board of managers of the State Charities Aid Association at a meeting held at the Bankers' Club, New York, Jan. 31.

WILLIAM C. HORNBERGER of Phoenix, Ariz., has been elected vice-president and general manager of the Arizona Edison Company, a subsidiary of the Peoples Light & Power Corporation. Mr. Hornberger was for several years assistant general manager of the Central Arizona Light & Power Company, controlled by the Electric Bond & Share Company.

DR. THOMAS H. MCLAUGHLIN, director of electrical supply of the Irish Free State, arrived in New York Jan. 25 aboard the Cunard liner *Aquitania*. Dr. McLaughlin is in the United States to study plant construction and operation methods of the American electrical industry. The construction of the hydro-electric developments on the Shannon River has been under the supervision of Dr. McLaughlin.

ROY COSBEY has been elected secretary and a director of the Wadsworth Electric Manufacturing Company to fill the vacancy created by the death of Richard J. Dibowski. For the past four years Mr. Cosbey has been the comptroller of this company and was previously connected with the Joslin-Schmidt Company, the Cincinnati Milling Machine Company, the Modern Foundry Company, and Ernst & Ernst, all of Cincinnati, Ohio.

WILLIAM C. L. EGLIN, vice-president and chief engineer of the Philadelphia Electric Company, is seriously ill. Mr. Eglin was on a cruise in the Caribbean Sea when he was stricken. He was transferred at Havana to a northbound steamer and on reaching Philadelphia was removed at once to the Jefferson Hospital in that city. Eminent specialists as well as the physicians of the Philadelphia Electric Company were called in consultation. Mr. Eglin is suffering from "sleeping sickness" and while the physicians hold out some hope for his recovery, they do not deny the seriousness of the case.

GEORGE C. HEISTERMAN, formerly assistant industrial development engineer of the Public Service Company of Northern Illinois, has been appointed industrial development engineer for that company. A graduate of the University of Iowa, Mr. Heisterman became associated with the company in 1924 as an assistant power salesman. In 1925 he became a power salesman and one year later assistant industrial development engineer.

WILLIAM J. CASEY, president of the Continental Trust Company, Baltimore, has been elected a member of the board of directors of the Consolidated Gas, Electric Light & Power Company of Baltimore. Mr. Casey is succeeding the late S. Davies Warfield on both the directorate and executive committee of the Consolidated company as he also did in the presidency of the Continental Trust Company. He recently was elected a director of the Washington, Baltimore & Annapolis Electric Railroad.

BARON JEAN DANIEL DE MONTENACH of Geneva arrived in New York Feb. 1 aboard the White Star liner Olympic. The baron will spend a month in the United States, acquainting himself with American methods of power development. He will study particularly the properties of the Virginia Electric & Power Company, formerly the Virginia Railway & Power Company, which the Engineers' Public Service Company purchased from Frank Jay Gould, whose daughter Helen he married. Baron de Montenach is a director in many French enterprises.

Obituary

ROBERT W. MUNK, production manager of the Crouse-Hinds Company, electrical manufacturer of Syracuse, N. Y., died Jan. 17 in that city after a short illness. Mr. Munk was 53 years of age.

LEON J. KENNEY, manager of the merchandising department of the Bristol (R. I.) Electric Company, died on Jan. 13. The Bristol company is affiliated with the Narragansett Electric Company, Providence.

RUDOLF V. ROSE, engineer and superintendent for the Empire Builders' Supply Company, Niagara Falls, N. Y., died Jan. 26 after a week's illness. A graduate of the Stevens Institute of Hoboken, Mr. Rose had formerly been connected with the Niagara Falls Power Company for more than twenty years. Starting in the capacity of draftsman, he later became chief draftsman and then assistant engineer. From 1907 to 1918 he served as construction engineer for the Niagara Falls Power Company, the Canadian Niagara Power Company and the Niagara Junction Railway Company. In 1920 he became president of the Consolidated Fuel & Supply Corporation, Niagara Falls, and four years later affiliated himself with the Empire Builders' Supply Company. Mr. Rose was 52 years of age.

Financial and Statistical News

Stocks Move Upward Money Rate at 4½ Per Cent Bond Market Firm

FOLLOWING the irregularity occasioned last week by the rise to 4 per cent in the Chicago rediscount rate, the market became firm and before the week closed the trend moved toward higher levels, with the utilities leading the upswing. Activity continued during the sessions this week and the utilities absorbed the bulk of interest. In fact, the utility group provided a background of strength for the market in general. Montana Power was the leader, advancing thirty-eight points in the course of a week. Brooklyn Edison advanced ten points during the week, while National Power & Light, Columbia Gas & Electric and Standard Gas & Electric made substantial gains. Other public utilities which continued in demand were Public Service Corporation of New Jersey, Pacific Gas & Electric, Southern California Edison and the Philadelphia Company.

The bond market was firm on the whole, wide fluctuations in prices being lacking. A feature of the week was the reduction from 5 to 4½ per cent in the call money rate.

Twelve-Million-Dollar Italian Loan Floated

First mortgage 6½ per cent sinking fund gold bonds, series A, of Terni-Società per l'Industria e l'Elettricità were offered the investing public Jan. 30 at 90¼ and interest, to yield about 7.35 per cent, a piece of financing involving a total of $12,000,000. Terni-Società per l'Industria e l'Elettricità, or "Terni" as it is known throughout Europe, was organized in 1884. The properties now in operation include four hydro-electric power stations located in the Apennine Mountains about 60 miles northeast of Rome, having a combined generating capacity of 86,200 kw. The company is building a new hydro-electric plant with an initial generating capacity of 105,000 kw., and in addition a subsidiary company, Società Elettrica dell 'Alto Nera, has under construction a plant with an initial generating capacity of 9,000 kw. These bonds will be a direct obligation of Terni-Società per l'Industria e l'Elettricità.

National Power & Light Increases Dividend Rate

Directors of the National Power & Light Company at the same meeting at which they voted to give in exchange one share of common stock of National Power & Light Company for each share of Lehigh Power Securities Corporation common stock also voted to increase the regular quarterly dividend rate on National Power & Light Company common stock for the payment due June 1, 1928, from 20 cents a share to 25 cents a share. The regular quarterly dividend of 20 cents payable March 1 was declared Jan. 19 and will be payable to stock of record Feb. 14. No dividend has ever been paid on Lehigh Power Securities Corporation common stock. Subject to the plan becoming operative, holders of Lehigh Power Securities Corporation stock who make the exchange for National Power & Light Company common stock on or before Feb. 14 will receive a dividend on March 1 of 20 cents a share and thereafter the regular quarterly dividend of 25 cents a share.

American Power & Light to Increase Capital

The American Power & Light Company, which in the near future is planning to acquire the Washington Water Power Company, as announced in the Jan. 21 issue of ELECTRICAL WORLD, has announced plans to increase its authorized preferred stock from 500,000 to 2,000,000 and the authorized common from 2,300,000 to 4,000,000 shares. The stockholders of the company have been notified of a meeting to be held Feb. 4, at which time the proposals will be submitted for approval. Common stock will be issued for expansion purposes.

Detroit Edison Revenue Increased 5.6 Per Cent in 1927

Statement Reflects Industrial Slackening, but Company Is Now in Position Where It Is Little Affected by Ups and Downs of Motor Industries

WITH the publication of Detroit Edison's financial statement for 1927, the first to be received this year by ELECTRICAL WORLD, the annual report period of the year again commences. The publication of these reports of 1927 activities is a matter of very considerable interest in the industry. Previous estimates can now be verified and a clear picture of what 1927 meant in the power and light industry can be secured.

Detroit Edison's report reflects the result of conditions existing in several industrial sections of the country and may be regarded as fairly representative of the large operating units serving industrial areas. Gross revenue increased only 5.6 per cent and net 3.6 per cent, which is considerably below the average rate of annual increase. This was due to relatively quiet conditions in certain large Detroit industries during all but the last few weeks of the year. Industrial slackening has been reflected in other branches of industry, and according to the statement the effect upon the power and light business was exactly that which has been observed in similar periods in the past. The usual compensatory causes, however, were operative in that the use of current by the average consumer is increasing. Furthermore, large industrial consumers increase their power purchases by nearly 3 per cent. It is intimated that the company has now reached a point where it will not be greatly affected by the ups and downs of a single industry, such as the automobile industry.

Examination of the earning statement of the company shows net income of $10,492,716 after depreciation, interest and federal taxes, which is equivalent to $11.32 a share on the common. This is exactly the same amount that was earned on common during the previous year. The operating ratio fell slightly, to 55.3 per cent. The average fuel required in 1927 by all the street power plants was only 1¼ lb. of coal for each kilowatt-hour of energy generated.

	For the Year 1927		For the Year 1926	
Gross earnings from all operations:				
Electricity	$44,759,413.36		$41,989,942.98	
Steam	2,223,656.44		2,459,046.62	
Gas	305,992.89		287,227.16	
Miscellaneous	90,716.01		118,518.68	
		$47,379,778.70		$44,854,735.44
Expense of all operations, including maintenance	$21,619,975.03		$21,310,959.02	
Retirement reserve (depreciation)	5,950,000.00		5,500,000.00	
Federal income and other taxes	4,586,000.00		4,049,600.00	
		$32,155,975.03		$30,860,559.02
Balance, being net earnings from all operations		$15,223,803.67		$13,994,176.42
Interest on funded debt	$4,888,716.56		$4,200,021.14	
Interest on unfunded debt	307,967.37		101,470.06	
	$5,196,683.93		$4,301,491.20	
Less amount charged to property account for interest on money borrowed for construction purposes	465,596.29		439,330.33	
		$4,731,087.64		$3,862,160.87
Net income		$10,492,716.03		$10,132,015.55

It is also noted that sale of electric energy to private consumers was by far the largest item. Sales to other public utilities were relatively small. The output of current was 2,142,549,100 kw.-hr., against 2,025,063,700 kw.-hr. in 1926. Kilowatt-hours actually sold were 1,811,-100,684, against 1,709,656,328 the year before. The reduction in the service rate which was made in 1926 brought the 1927 average price for this class of service down to 4.7 per cent per kilowatt-hour. This price includes current, lamp renewals and servicing. The average of the supply to domestic consumers was 544 kw.-hr. In 1920 the figure was 415 and in 1923 it was 460.

The income account of the company and subsidiary utility companies for 1927 and for the previous year is as shown on the preceding page.

NEW ENGLAND POWER BONDS TOTAL $12,223,000.—In an article entitled "New England Power to Issue New Stocks" appearing on page 124 of the Jan. 14 issue of ELECTRICAL WORLD, the face value of the bonds of the New England Power Company outstanding was quoted at $2,223,000. This figure should have been $12,223,000.

An Investor's View of Utility Investigation

Hearing of Interstate Commerce Committee Brings Out Investors' Scrutinizing of Utility Securities—Testimony of Vice-President of Metropolitan Life Insurance Company

A NUMBER of points of importance to public utility companies and security holders were brought out at the hearing before the Senate committee on interstate commerce recently when Mr. Ecker, vice-president of the Metropolitan Life Insurance Company and chairman of the National Association of Owners of Railroads and Public Utility Securities, Inc., was heard. This association, it will be recalled, was reorganized recently as what might be called the mouthpiece of the large body of security holders in all classes of utilities and railroads, which comprises institutions which hold investments somewhat in the relation of trustees.

As was pointed out by Mr. Ecker, a great proportion of the population of the country is directly or indirectly affected either through direct holdings or through insurance companies. Over 62,000,000 individuals are affected, to a greater or lesser degree. Illustrating the wide interest in the subject, Mr. Ecker called attention to the fact that his own company alone has fourteen and a half billions of dollars of insurance in force, insuring individual lives in the number of about 27,000,000. This company's holdings of public utility securities are approximately $200,000,000. It was furthermore pointed out that savings banks have resources of $9,000,000,000 and have between eleven and twelve million individual depositors and these institutions hold between three hundred and three hundred and fifty million dollars of public utility securities.

Asked whether or not, in the course of his experience, Mr. Ecker had run across anything at all that would indicate that there is need for federal investigation of public utility companies, his answer was, "No!" He modified this, however, by explaining that the bonds which the company held were those only of operating companies in

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Jan. 31	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	163	140½*	164*
Ala. Pwr., $7 com. pf.—no par	114½	107	115
Allis-Chalmers Mfg., 6% com	116	115½*	120½*
Aluminum Co. of Amer., com	128½	120*	129½*
Aluminum Co. of Amer., 6% pf	106½	105½*	106½*
Amer. & Foreign Pwr., 7% pf.—no par	107½	105½*	108½*
Amer. & Foreign Pwr., com.—no par	25	22½*	27*
Amer. Bosch Magneto, com.—no par	19½	19 *	22½*
Amer. Brown Boveri Elec.†	18	14½*	18*
Amer. Brown Boveri Elec., pf. $7	62½	58*	63*
Amer. Gas & Elec., 6% pf.—no par	107½	106½*	109*
Amer. Gas & Elec., com. †—no par	124½	117*	125½*
Amer. Lt. & Trac., 6% pf	115½	115½*	115½*
Amer. Lt. & Trac., new com	172	170*	174½*
Amer. Pwr. & Lt., 6% pf	107½	107½*	109½*
Amer. Pwr. & Lt., com. †—no par	6;	62½*	69½*
Amer. Pub. Serv., 7% pf	*a* 96	99*	100*
Amer. Pub. Serv., com. †	*k* 70	65	75
Amer. Pub. Utilities, 7% pfc. pf	93	73	90
Amer. Pub. Utilities, 7% pr. pf	96½	....	....
Amer. Pub. Utilities, com	*k* 60	58	70
Amer. States Sec., A	4	2½	5½
Amer. States Sec., B	4½	2½	5½
Amer. Superpwr., 6% ptc pf.—25	*k* 29½	29	29½
Amer. Superpwr., 6% 1st pf	*l* 102½	....	....
Amer. Superpwr., Class A†—no par	40½	37*	41 *
Amer. Superpwr., Class B†—no par	40½	37½*	41½*
Amer. Wtr. Wks. & Elec., 6% pf	*k*104	101½*	104*
Amer. W.W. & E., com. new—no par	59½	56½*	61*
Anaconda Copper cap. $3	56½	53½*	59½*
Appalachian Electric Pwr., 7% pf	109	100	109
Arkansas Pwr., & Lt. 7% pf	107½	101	108
Assoc. Gas & Elec., $3.50—50	54	....	....
Assoc. Gas & Elec., pf.—$6—no par	98	85	98
Assoc. G. & E., Class A, 10—no par	47½	47½*	51½*
BABCOCK & WILCOX, 7% com.	122½	120*	124½*
Binghamton L., H. & P., $6 pf	103½	93	103½
Birmingham Elec., pf.—$7—no par	109½	105	111½
Blackstone Valley G. & E., 6% pf	*k*107	103	110
Blackstone Valley Gas & Elec., 10% com.—50	*k*128	98	153
Blaw-Knox, com.†	*i* 94	91*	95*
Brazilian Trac., Lt. & Pwr., $7 com.	*f*199	....	....
Broad River Pwr., 7% pf	104	97	105½
Brooklyn Edison, 8% com	235½	206½*	235½*
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	*i* 26	....	....
Buffalo, Niagara & East. Pwr. com. $1.20—no par	*i* 35	....	....
CALIFORNIA ELEC. GENERATING, 6% pf	*k* 98	96	104½
California Pwr. & Pwr., 7% pf	*k*135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	*l*110½	109*	110½*
Central & S. W. Util., $7 pf.—no par	*a*103½	99½*	105½*
Central & S. W. Util., pr. ln. $7 pf.—no par	*a*107½	105½*	107½*
Central Ark. Ry. & Lt., 7% pf	104	100	107
Central Ill. Pub. Serv., $6 pf	*a* 98	97½*	98½*
Central Ind. Pwr., 7% pf	*a* 96½	95*	96½*
Central Maine Power, 6% pf	96½	....	....
Central Maine Power, 7%	106	102	110
Central Pwr. & Lt., 7% pf	105	100½	105
Central States Elec., 7% pf	107½	104½*	107½*
Century Elec., 6% com	*b*145	140*	145*
Chicago Fuse Mfg., com.—$2.50 no par	*a* 33	31	33½*
Cincinnati Gas & Elec., 5% com	*g* 99½	98½*	100*
Cities Service, $6 pf.—no par	*i* 95½	87*	94½*
Cities Service, pf. B—no par	*l* 9	8*	8½*
Cities Service, pf. BB—no par	*l* 90	80½*	86*
Cities Service, com.—20	*l*55½	40½*	58½*
Cities Service, Bks. Shrs.—10	*l* 27½	22½*	27 *
Cities Service Pwr. & Lt., 7% pf	*k*105½	105½*	106½*
Cities Service Pwr. & Lt., 6% pf	96½	95½*	96½*
Cleveland Elec. Illg., 6% pf	113	108	114
Cleveland Elec. Illg., 10% com	350	285	370
Columbia Gas & Elec., 6% pf	108	108*	110½*
Columbia G. & E. com. $5—no par	97½	89½*	97½*
Columbus Elec. & Pwr., $2 com.—no par	*m* 65	....	....
Columbus Elec. & Pwr., 7% pf	112	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	105	98½	108½
Columbus Ry., Pwr. & Lt., 7% pf. B	105	96	106
Columbus Ry., P. & Lt. com.—no par	*k*105	75	110
Commonwealth Edison, 8% com	*a*169	165*	169*
Commonwealth Pwr., 6% pf	102½	102½*	104½*
Commonw'th Pwr., $2, com.—no par	67½	62½*	68½*
Conn. Lt. & Pwr., 8% pf	121	119	123
Conn. Lt. & Pwr., 7% pf	117	112	119
Cons. Gas of N. Y., pf	102½	101½*	102½*
Cons. Gas of N. Y., com. $5—no par	127½	119½*	128½*
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf	*e*113	110½*	113*
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf	*e*110½	110½*	113*
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf	*e*110½	110½*	115*
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf	*e*125½	125½*	128½*
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par	*e* 70½	67½*	70½*
Consolidated Pwr. & Lt., 7% pf	105	100	106
Consumers Pwr., 6% pf	104½	100	106½
Consumers Pwr., 6.6% pf	106½	103	107½
Continental Gas & Elec., 8% ptc. pf.	110½	103	110
Continental Gas & Elec., 7% pr. pf.	107½	100	107½
Conti. G. & E. com. $4.40—no par	*k*225	210	265
Crocker Wheeler, com.†	26	23	38
Crocker Wheeler, 7% pf	85	78	88
DALLAS PWR. & LT., 7% pf	110	107	111½
Dayton Pwr. & Lt., 6% pf	108½	101	109½
Detroit Edison, 8% com	174½	166½*	176½*
Dubilier Condenser, com.—no par	2½	2½*	3½*
Duke Pwr., cap	139	135*	145*
Duquesne Lt., 7% pf	116	115½*	116*
EASTERN NEW YORK UTIL., $7 pf	*k*110½	102	112½
Eastern New York Util. com	*k* 65	70	75
Eastern States Pwr. $7, com	*k* 12	11½*	13½*
Eastern States Pwr., pf	*k* 97	90	99
East. Tex. Elec., 7% pf	108	106	109
Edison Elec. of Boston, $12 com	*d*262½	259*	268*
El Paso Elec. 7% pf	112	105	112½
Elec. Bond & Share, 6% pf	*l*110	109½*	111½*
Elec. Bd. & Sh. Sec., com. $1—no par	*l* 88	76*	80½*
Electric Household Util.†	*a* 15½	13½*	15½*
Elec. Investors, 6% pf.—no par	102	92	101
Elec. Investors, com.†—no par	43½	40½*	45½*
Elec. Pwr. & Lt., ctfs. pf	107½	106½*	107½*
Elec. Pwr. & Lt., ctfs., 40% pd	*k*123	120½*	123*
Elec. Pwr. & Lt., ctfs., com.—no par	33½	28½*	34½*
Elec. Refrig. cap.†	12½	11½*	13½*
Elec. Ry. Securities, com.—no par	6½	....	....
Elec. St. Battery com. $5.25—no par	71½	69½*	75½*
Elmira Wtr., Lt. & R.R., 7% pf	*k*105	99	105½
Empire Pwr., ptc.†	35½	27½*	35½*
Engr. Pub. Serv. $7, pf.—no par	108	107*	109*
Engr. Pub. Serv., com.—no par	35½	34½*	36½*
Eureka Vacuum Cleaner, com. $4—no par	75½	73½*	79*
FAIRBANKS MORSE, 7% pf	*k*106	104*	104*
F.-M., com.—$3—no par	*k* 36	32½*	40½*
Federal Lt. & Trac., com $1.40	55	42*	55*
Federal Lt. & Trac., $6 pf.—no par	104½	98*	105*
Florida Pwr. & Lt., 7% pf	106½	104½*	107*
Ft. Worth Pwr. & Lt., 7% pf	*l*113½	113*	114½*
GALVESTON-HOUSTON ELEC. 6% pf	76	68	85
Galveston-Houston Elec., com	32	26	32
General Cable, Cl. A $1 no par	58½	56½*	60*
Gen. Elec. $3 com.—no par	130½	129½*	138½*
Gen. Elec., special—6%	11½	11½*	11½*
Gen. Gas & Elec. (Del.) com A $1.50—no par	38½	35½*	39½*
Gen. G. & E. (Del.) pf. A $8—no par	*k*123	123*	126½*
Gen. G. & E. (Del.) pf. A $7—no par	*k*110	108½*	110*
Gen. G. & E. (Del.) pf. B $7	*k*106½	105½*	106½*
Gen. Pub. Serv., $7 cum. pf., no par	*k*110	102	112
Gen. Pub. Serv., com., no par	19½	16½*	20½*
Ga. Lt., Pwr. & Rys., com	*k* 59	50	70
Ga. Ry. & Pwr., 8% pf	*k*125	119	125
Ga. Ry. & Pwr., 7% pf	*k*113½	106	115
Gt. Western Pwr., 7% pf	*h*105	....	....
IDAHO PWR., 7% pf	108½	103	110
Ill. No. Utilities, 6% pf	*a* 98½	98½	99
Ill. Pwr. & Lt., 7% pf	104	99	104½
Ingersoll Rand com	*k* 92	91*	94*
Int. Combus. Engr., com. $2—no par	53½	49*	55½*
Int. Combustion Engr., 7% pf	105½	104½*	105½*
Int. Util., Class A—$3.50—no par	*k* 48½	48*	51½*
Int. Utilities, Class B—no par	9½	9*	10½*
Interstate Pwr., pf.—$7—no par	98½	93	100
Interstate Pub. Serv., 7% pf	102	98	104
Iowa Ry. & Lt., 7% pf	*k* 98½	97	100
JERSEY CENTRAL PWR. & LT. CO., 7% pf	105½	97½	108
Johns-Manville, com.†—no par	122½	114½*	124½*

Stock Exchange: *a*Chicago; *b*St. Louis; *e*Philadelphia; *d*Boston; *e*Baltimore; *f* Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Jan. 28. *l*Bid price Wednesday, Feb. 1. *m*Latest quotations available. †Dividend rate variable *1928

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Jan. 31	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf. $7	k115¼	115*	115¼*
Kansas Gas & Elec., 7% pf.	l109	107*	109*
Kentucky Hydro-Elec., 7% pf.	a102½	102*	103*
Kentucky Sec., 6% pf.	91	83	90
Kentucky Sec., 5% com.	140	100	135
Kentucky Utilities, 6% pf.	k101	95	101½
LACLEDE GAS LT., 12% com.	k246	200*	245*
Lehigh Pwr. Sec., com.—no par.	25½	19½*	27½*
Long Island Ltg., 7% pf.	111	107	112½
Long Island Ltg., com.†—no par.	k170	139	180
Los Angeles Gas & Elec., 6% pf.	106	98	105
Louisville Gas & Elec., cl. A. $1.75	28½	28½*	29½*
MAN. ELEC. SUPPLY, cap. $5—no par.	50½	50*	54½*
Manilla Elec., com.†—no par.	k 45½	40	60
Maytag Mfg., com. .50—no par.	32¾	32½*	34½*
Memphis P. & L., pf.—$7—no par.	k109½	107	111
Metropolitan Ed., pf.—$6—no par.	106	93	106
Metropolitan Ed., pf.—$7—no par.	109	104	110
Metropolitan Ed., com. $5—no par.	k125	60	72
Middle West Utilities, 7% pf.	a122	116½*	123½*
Middle West Util., 7% pr. lien	a127½	125½*	128½*
Middle West Util., com. $6—no par	a132½	123½*	134½*
Midland Utilities, pr. ln. 6% pf.	a106	105*	106*
Midland Utilities, 7% pf. A	a104½	103*	104½*
Milwaukee Elec. Ry. & Lt., 7% pf.	k103	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k 99	98	101½
Minn. Pwr. & Lt., 7% pf.	l108½	107*	109*
Miss. River Pwr., 6% pf.	108	94	108
Miss. River Pwr., 3% com.	m 62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	k109	100	109
Mohawk Hudson Pwr., 2d pf.—$7—no par.	k104	100	109
Mohawk Hudson Pwr., com.—no par	31	29½*	31½*
Montana Pwr., 5% com.	161½	102½*	161½*
Montreal Pwr., 7% com.	f 91½	....	....
Mountain States Pwr., 7% pf.	k102½	97	103
Mountain States Pwr., com.†	17	....	....
NASSAU & SUFFOLK LTG., 7% pf.	110	98	110
National Carbon, 8% pf.	a138½	138*	139*
National Elec. Pwr., A†	a 29	27½*	29*
National Lt., Ht. & Pwr., com.	k 24	20	30
National, Light, Ht. & Pwr., 5% pf.	k 72	70	80
National Pwr. & Lt., pf.—$7—no par	k109	108½*	110*
National Pwr. & Lt., com.†—no par.	25½	21½*	27½*
National Pub. Serv., 7% pf.	100	93	102
National Pub. Serv., 7% pfc., pf.	114	108	115
National Pub. Serv., A com. $1.60—no par.	23	22*	23½*
National Pub. Serv., B com.—no par	27¼	24½*	27½*
Nebraska Pwr., 7% pf.	l110½	110*	111½*
Nevada-Calif. Elec., com.	k 33	22	37
New Brunswick Pwr., 4% pf.	k 60	60	70
New Eng. Pub. Serv., pr. ln. pf. $7	k104	98½	104
New Eng. Pub. Serv., pf. $7	k102	95	100
New Orleans Pub. Serv.—7% pf.	108½	103	110
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	100	91	100
N. Y. Central Elec., 7% pf.	k103	101	104
New York Power & Light, 8% pf.	114	....	....
New York Power & Light, 7% pf.	114	....	....
Newport News & Hampton Ry., Gas & Elec., 5% com.	k109	110	115
Newport News & Hampton Ry., Gas & Elec., 7% pf.	k109	110	115
Niagara Falls Pwr., 7% pf.—25.	28½	28*	28½*
No. Amer., 6% pf.—50.	54½	53½*	54½*
No. Amer., com.—10.	61	58½*	62½*
No. Amer. Edison, $6 pf.—no par.	k105½	103½*	105½*
No. Caro. Pub. Serv., pf.—$7—no par	105½	93	105
Northeastern Pwr., com.	20½	19½*	22½*
No. N. Y. Utilities, 7% pf.	107	103	109
No. Ohio Pwr., com.—no par.	24	18*	24½*
No. Ont. Lt. & Pwr., 6% pf.	98½	98*	98½*
No. Ont. Lt. & Pwr., 4% com.	k 72	73	78
No. States Pwr. (Del.), 7% pf.	109½	108½*	109½*
No. States Pwr. (Del.), 8% com.	134¾	123*	135½*
No. Texas Elec., 6% pf.	53	45	70
No. Texas Elec., com.	17½	5	36
OHIO BRASS, com. B $4—no par.	98	89*	98½*
Ohio Brass, 6% pf.	k106	100	111
Ohio Pwr., 6% pf.	105½	96	106
Ohio Pub. Serv., $6 pf.	k102½	95	102
Ohio Pub. Serv., 7% pf.	109½	103	111
Ohio River Edison, 7% pf.	108½	103	109½
Oklahoma Gas & Elec., 7% pf.	111	....	....
PACIFIC Gas & ELEC., 6% pf.	27½	26½*	27½*
Pacific Gas & Elec., 8% new com.	49½	47½*	49½*
Pacific Pwr. & Lt., 7% pf.	l109	106*	108½*
Penn Cent. Lt. & Pwr., $5 pf.—no par.	c 79	77½*	79*
Penn-Ohio Edison, 6% pf. no par	k 90	78	91
Penn-Ohio Edison, 7% pf.	k107½	97½	104
Penn-Ohio Pwr. & Lt., 7% pf.	109½	99	110
Penn Pwr. & Lt.—$7—no par.	l110½	109½*	110½*
Penn Wtr. & Pwr., 8% com., new	e 71½	68*	72*
Phila. Co., 5% pf.—50.	k 46½	46½*	48½*
Phila. Co., 6% pf.—50.	52½	52*	52½*
Phila. Co., com.—50.	163	149½*	163*
Phila. Elec., 8% com.—25.	c 57½	55½*	58½*
Portland Elec. Pwr., 7% pf.	103	97½	102½
Portland Elec. Pwr., 6% pf.	91½	78	84
Portland Elec. Pwr., 6% 2d pf.	81½	55	70
Portland Elec. Pwr., com.	43½	42½*	43½*
Potomac Elec. Power, pf.	k111	110	111½
Pwr. Sec., pf.—no par.	61	61*	62½*
Pwr. Sec., com.—no par.	k 12	5	15
Public Serv. of Colorado, 7% pf.,	l107	99*	103*
Pub. Serv. of N. J., 6% pf.	105	103½*	105*
Pub. Serv. of N. J., 7% pf.	120	118*	120½*
Pub. Serv. of N. J., $2 com.—no par	44½	41½*	45*
Pub. Serv. of No. Ill., 6% pf.	a111	111*	113½*
Pub. Serv. of No. Ill., 7% pf.	a120	120*	120½*
P. S. of No. Ill., com. $8—no par.	a162	159½*	162*
Pub. Serv. of No. Ill., $8 com.	a161	132	161½
Pub. Serv. of Okla., 7% pr. ln.	k103	90	103
Pub. Serv. Elec. & Gas, 6% pf.	109½	109*	110*
Puget Sound Pwr. & Lt., 7% pf.	111	109*	113*
Puget Sound Pwr. & Lt., $6 pf.—no par.	m 99	....	....
Puget Sound Pwr. & Lt., com.	44½	34½*	46½*
RADIO COPR. OF AMER., $3.50 pf.—50.	55½	54½*	57½*
Radio Corp. of Amer., com.—no par.	101½	88½*	104½*
Rhode Island Public Service, pf. $2—no par.	k 31	30½*	31*
Rochester Gas & Elec. 6% pf. D.	k105½	101	103½
Rochester Gas & Elec. 7% pf. B.	107	105	107
Rochester Gas & Elec., 6% pf. C.	105½	101½	103½
SAN JOAQUIN Lt. & Pwr., 7% pr. pf.	k111	105	112½
St. Joseph Ry., L., H. & P., 5% pf.	k 75	70	75
Servel Corp.	k 5½	4½*	6¼*
Sierra Pacific Elec., 2% com.	32½	29*	33*
Sioux City Gas & Elec., 7% pf.	108	99	105½
Southeastern Pwr. & Lt., pf.—$7—no par.	l108½	....	....
Southeastern Pwr. & Lt., ptc. pf.	l 89½	....	....
Southeastern Pwr. & Lt., com.—no par.	44	42*	44½*
So. Calif. Edison, 8% pf.	k 45	36½	40
So. Calif. Edison, 7% pf.	k 28	27½	28½
So. Calif. Edison, 6% pf.	27½	25½*	27½*
So. Calif. Edison, 8% com.	47½	43½*	47½*
Southern Cities Utilities, 7% pf.	k 74½	67	90½
Southwestern Lt. & Pwr., A $3.	70	60	65
Southwestern Lt. & Pwr., B.	70	60	65
Southwestern Lt. & Pwr., $6 pf.	90	83	91½
Southwestern Pwr. & Lt., 7% pf.	111½	110*	111½*
Standard Gas & Elec., 8% pf.	67	65*	67*
Standard Gas & Elec., 7% pr. pf.	111	103	113
Standard G. & E., com. $3.50	64½	57½*	65*
Standard Power & Light, com.	m 30	30*	33½*
Standard Pwr. & Lt., 7% pf.	k104	103½*	105*
Staten Island Edison, pf.—$6—no par.	102	99	103
Superheater, $6 com.—no par.	175	164*	178*
Syracuse Lighting, 7% pf.	k111	103	111
Syracuse Lighting, 8% pf.	k117½	114	119
TAMPA ELEC., com. $2.	62½	62*	64*
Tenn. Elec. Pwr., 6% pf.	102½	92	103
Tenn. Elec. Pwr., 7% pf.	109½	103	110
Terre Haute, Ind. & East. Trac., 5% pf.	k 26	20	30
Terre Haute, Ind. & East. Trac., com.	k 1	1	3
Tex. Pwr. & Lt., 7% pf.	l113½	113½*	115*
Tide Water Pwr., 8% pf.	111	105	111
Timken Roller Bear., com.—$4 no par.	128½	126½*	134*
Toledo Edison, 7% pf.	l109	102*	107*
Toledo Edison, 6% pf.	k103	95	105
Toledo Edison, 6% com.	k100	93	102
Tri-City Ry. & Lt., 6% pf.	k 97½	96	99
UNITED GAS & ELEC., 7% pf.	101½	98	103
United Gas & Elec. (N. J.), 5% pf.	74	70	77
United Gas Impr., 8% com.—50.	c116	111½*	117½*
United Lt. & Pwr., pf.—$4—no par.	a 53	53*	55*
United Lt. & Pwr., pf.—$6.50—no par.	a100	95*	100*
United L. & P., com. A .48—no par.	a 16	14*	16*
United L. & P., com. B .48—no par.	a 20	19*	20*
Utah Pwr. & Lt., 7% pf.	l111½	109½*	111*
Utica Gas & Elec., 7% pf.	106	105	106½
Utica Gas & Elec., 8% com.	k200	215	225
Utilities Pwr. & Lt., 7% pf.	98½	93	100
Utilities Pwr. & Lt., com. A $2.	30½	28½*	30½*
Utilities Pwr. & Lt., com. B $1—no par.	k20½	18½*	20½*
VERMONT HYDRO-ELEC., 7% pf.	k 97	95	100
Virginia Elec. & Pwr., 7% pf.	k108	105	110
WAGNER ELEC., 7% pf.	b 99½	96½*	99½*
Wagner Elec., com.—no par.	b 38	37½*	40*
Washington Ry. & Elec., 5% com.	k460	180	475
Washington Ry. & Elec., 7% pf.	102	....	....
Washington Wtr. Pwr., 8% com.	k215	136	182
West Penn Elec., 7% pf.	110½	110½*	114½*
West Penn Elec., Cl. A $7.	109½	106½*	109½*
West Penn Pwr., 7% pf.	116	114½*	116½*
West Penn Pwr., 6% pf.	110	109½*	113*
West Virginia Lt., Ht. & Pwr., 7% pf.	k 95	94	100
Western Pwr., 7% pf.	k102	98	105
Western States Gas & Elec., 7% pf.	102	96	106
Western States Gas & Elec., com.	38	....	....
Westinghouse Elec. & Mfg., 8% com.—50.	96½	88½*	100½*
Weston Elec. Instrument, Cl. A $2—no par.	33	30½*	33*
Weston Elec. Instrument, com.—no par.	k 14½	12½*	14½*
Wheeling Elec., 6% pf.	k103	95	104
Worthington Pump, 7% pf. A.	54½	46½*	54½*
Worthington Pump, 6% B.	49	41*	49*
Worthington Pump, com.	33½	28*	34½*
YALE & TOWNE com. $5—25.	72½	72½*	75*

Stock Exchange: *c*Chicago; *b*St. Louis; *e*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Jan. 28. *l*Bid price Wednesday, Feb. 1. *m*Latest quotations available. †Dividend rate variable. *1928

which there was a direct mortgage on property. Relative to the nature of the inquiry, Mr. Ecker said: "As I observe it, this business must be very substantially, very materially and extensively expanded in the next few years, and thinking solely from the standpoint of the financial side of it I feel, and am confident that you would feel, that it is important that confidence in these securities and in these sound organizations should not be disturbed. I took comfort in the Senator's presentation of the subject yesterday, when he said he realized that danger and that it was farthest from his thought that such a result would ensue unless there should develop circumstances that would indicate there were abuses that should be corrected, but that it was his desire, or at any rate he felt the importance of doing nothing that would unduly disturb the credit situation. In conclusion, I only have to add that it is the hope of the interests that I am speaking for that if it be determined that an investigation be had it should be conducted in the form of a fact-finding matter and along the lines of a judicial inquiry. I emphasize that to you, as a part of our thought on the subject, with a great deal of confidence that this committee will have those considerations in mind."

Factors Considered in Buying Securities

Mr. Ecker was asked whether, in buying bonds, his company makes a distinction between bonds issued by a corporation operating in a state where there is strong regulation resulting from vigorous policy and those where there is no regulation of that character. The answer was that there is a sort of framework or standard required to determine the acceptable offerings among these issues. This, it was admitted, would be one factor. Then there is the population served, the reasonable permanence of that property, the age of the property, its capacity, what its reports show are its costs of production compared with production costs in other localities or a similarly situated locality. Mr. Ecker stated that his company was particularly interested always in the methods of accounting of these operating companies, seeing to it that they set up proper reserves for depreciation and obsolescence. Mr. Ecker stated that his company would prefer to buy bonds where they are subject to state regulatory bodies because "Our observation is that even where these facilities are what might be termed monopolies, if they are regulated monopolies the service to the public is secured at a lower price than where there is competition without regulation. My personal opinion is that

these securities would be safer for the public to invest in."

Questioning by members of the committee elicited the information that the company rejects certain securities not always because of the question of security but sometimes because of the rate of interest. Sometimes the committee naturally feels that the offering does not yield as good a return as it should.

Company Reports

Name of Company	Gross Earnings Twelve Months Ended Dec. 31 1927	1926
Bangor Hydro-Electric	$1,867,760	$1,732,114
Baton Rouge Electric	1,017,110	960,479
Binghamton Lt., Ht. & Pwr.	2,276,827	1,958,545
Blackstone Valley Gas & Elec.	5,910,629	5,528,770
Cape Breton Electric	656,656	612,630
Carolina Power & Light	*8,900,700	*8,086,081
Central Illinois Light	4,391,161	4,197,747
Cleveland Elec. Illuminating	23,609,479	22,048,268
Columbus Elec. & Pwr. & Subs.	4,200,699	3,777,339
Commonwealth Power	53,172,977	49,197,543
Consumers Power	26,612,449	24,135,477
Detroit Edison	47,379,779	44,854,735
Eastern Texas Electric	7,214,132	5,657,495
Edison Elec. Illg. of Brockton	1,942,473	1,756,686
Electric Light & Power of Abington & Rockland	627,857	580,914
El Paso Electric	2,998,271	2,836,915
Federal Light & Traction	*6,962,554	*6,547,496
Galveston-Houston Electric	5,052,638	4,589,081
General Gas & Electric	25,347,713	24,771,054
Illinois Power	2,637,188	2,581,131
Lehigh Power Securities(subs.)	39,007,415	37,495,707
Lowell Electric Light	1,788,419	1,728,755
Metropolitan Edison	10,600,634	9,859,831
New York Power & Light	18,799,093	17,810,759
Northern Ohio Power	12,575,214	12,040,841
Northern Texas Elec. & Subs.	2,707,487	2,524,333
Ohio Edison	1,921,427	1,815,937
Portland Electric Power	12,154,452	11,763,567
Puget Sound Pwr. & Lt. & subs.	14,925,482	13,533,748
Savannah Electric & Power	2,227,380	2,233,704
Sierra Pacific Electric & subs.	1,240,946	1,260,542
Southern Indiana Gas & Elec.	3,038,391	2,883,251
Tampa Electric & subs	4,714,686	4,871,773
Tennessee Electric Power	12,515,760	11,909,560
Virginia Elec. & Pwr. & subs.	15,471,570	14,378,199

* Twelve months ended Nov. 30, 1927.

RECENT LISTINGS.—The New York Stock Exchange has authorized the listing of 79,000 additional shares of preferred stock of the American & Foreign Power Company, Inc. ($7 cumulative dividend), without par value, making the total amount of such preferred stock applied for 479,000 shares. The New York Exchange has also authorized the listing of additional cumulative 6 per cent preferred stock, series A, of the Columbia Gas & Electric Corporation to the amount of $2,666,600 and 13,372 additional shares of class A stock without par value of the Utilities Power & Light Corporation. There has been authorized the listing of 5,088 additional shares of common stock, class A, without par value, of the General Gas & Electric Corporation and 12,244 additional shares of its common stock, class B, without par value, on official notice of issuance and payment in full, making the total amount applied for 345,747 shares of common stock, class A, and 216,310 shares of the common stock, class B.

Stock Sales to Customers Exceed $18,000,000

Sales of stock by electric light and power companies directly to customers and employees in November aggregated 243,400 shares valued at $18,303,000 and involving 24,410 transactions. These estimates are based on returns from companies serving 87 per cent of the whole number of customers of all companies selling securities locally, with estimates for companies not reporting.

After the year's minimum and maximum were successively reached in September and October the returns indicate that November was an average month as to value of securities, number of transactions and their average magnitude, the latter about $750. Sales in November, 1926, were $19,060,000, but the average transaction involved only $500. Of the $18,303,000 slightly less than $2,000,000 was in the form of low-priced shares, the balance was at or near $100 per share. Seven companies each reported over $1,000,000 and three of these approached or exceeded $2,000,000; $16,100 was reported in red, which is assumed to mean that securities were returned to the companies.

Public Service of New Jersey to Raise $43,689,000

The Public Service Corporation of New Jersey will offer to its common and 8 per cent preferred stock holders this month twenty-year 4½ per cent convertible debentures to the amount of $43,689,000. The holders of each fifty shares of stock will have the right to subscribe for $500 principal amount of the new debentures at 98 and interest. The debentures will be convertible before Feb. 1, 1930, into common stock at the rate of twenty-two shares for each one-thousand-dollar debenture. Proceeds from the sale will be used to redeem $19,384,0000 of 6 per cent secured gold bonds and $15,000,000 of 5½ per cent secured bonds and for other corporate purposes.

January Issues Total $98,850,000

During the month of January the electric light and power companies of the country issued new securities to the amount of $98,850,000, a figure which compares with $223,859,000 for January, 1927, and $303,332,500 for December, 1927. These two months, however, were the high spots in new electric light and power financing in 1927. The Continental Gas & Electric Corporation contributed $36,000,000 to the month's total, the issue being in the form of thirty-year gold debentures priced at 95½. The only other offering exceeding $10,000,000 was made by the Lexington Water Power Company, a piece of financing involving a sum of $12,000,000.

Financing in January was almost exclusively of a long-term nature. The average yield advanced from the 5.06 per cent mark in December to 5.40 in January, the highest rate since last June.

Security Issues of Electric Service Companies in January

Name of Company	Amount of Issue (Par Value)	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
American Water Works & Electric Co.	$3,000,000	47	Gold debentures, series B	To reimburse company in part for expenditures in connection with the acquisition of additional properties, for additional working capital and for general corporate purposes	5	95	5.28
Lexington Water Power Co.	12,000,000	40	First mortgage gold bonds	Construction	5	98	5.10
	5,000,000	25	Convertible sinking fund gold debentures		5½	98½	5.60
National Electric Power Co.	5,000,000	..	Cumulative preferred stock	To retire notes and for other corporate purposes	6	94½	6.35
	10,000,000	..	Secured gold debentures		5	94½	5.30
Arizona Edison Co.	1,700,000	20	First mortgage gold bonds	Acquisition of certain properties and for other corporate purposes	5	96	5.33
Gulf States Utilities Co.	3,000,000	..	Preferred stock	To provide additional capacity or to reduce notes payable	6	100	6
Central Public Service Corp.	1,500,000	..	Cumulative preferred stock	To invest in additional stock	7	100	7
Continental Gas & Electric Corp.	36,000,000	30	Gold debentures	To retire securities	5	95½	5.30
United Public Service Co.	2,400,000	14	Collateral trust gold bonds, series A.	To acquire additional subsidiary securities	6	98	6.20
Consolidated Gas, Electric Light & Power Co. of Baltimore	10,000,000	..	Cumulative preferred stock, series A.	To retire outstanding issues and to reimburse for the cost of additions and for other capital expenditures	5	100	5
Washington Gas & Electric Co.	1,250,000	25	First mortgage gold bonds		5½	100	5.50
Central States Utilities Corp.	3,000,000	10	Secured gold bonds	To acquire stocks of subsidiaries, to provide funds for the retirement of their bonds and stocks and for other corporate purposes	6	98	6.25
General Public Service Corp.	5,000,000	25	Convertible gold debentures	To provide funds for investment	5	97½	5.19
Total	$98,850,000	(par value)		Rights	$657,750		
Total amount actually realised	95,626,500			Total financing for January	96,284,250		

Business News and Market Conditions

INDUSTRIAL equipment orders and inquiries continue to dominate the New England market. Small motor sales have gained and inquiries for turbo-generators of the lower ratings are being received by manufacturers. Increased buying is noted in the Eastern district, and one manufacturer stated that business appears to be even better than was expected. Orders are small, but gross sales are high. Wire and cable sales are slow, but present inquiries from the New York zone presage betterment. In the Southeast inquiries and orders show an increase. The engineering contract was let for a two-million-dollar plant in Texas. A textile mill contract let covered $70,000 worth of electrical materials and another planned involves $30,000 worth of electrical equipment.

In the St. Louis district business shows an improvement. Motors and control sold to a steel company amounted to $30,000 and elevator orders totaled $40,000. Industrial conditions improve in the Middle West and utility companies are planning many extensions. On the Pacific Coast several large projects include a 360,000-hp. hydro-electric plant on the Feather River, a 35,000-kw. steam turbine plant in the India Basin of San Francisco, a soap plant costing $700,000, two large apartment houses totaling $1,600,000 and transmission line installations in western Washington.

Large Order Placed in Metal Market

Buying of non-ferrous metals has been small, but prices are little changed from those obtaining last week Wednesday in the domestic market. Copper has been particularly dull, but there is only a negligible decline in the quoted price. On Wednesday afternoon wire drawing interests entered the copper market rather unexpectedly and purchased about 5,000,000 lb. of copper at 14⅛ cents, delivered in Connecticut. These sales were distributed among several sellers and in the aggregate formed a considerable proportion of the business of a comparatively dull week. A moderate business was done in both lead and zinc, prices for the former tending to weaken as a consequence of material declines in London, while zinc became slightly firmer. Both buyers and sellers appear to be marking time. Primary producers of copper continue to stand pat at the 14⅛ cent price. Moreover, they have made sales at that figure each day during the week. On the other hand, one or two custom smelters have shaded the even eighth by from 2½ to 5 points. Incidentally, two interests that come under this classification have been firm at 14⅛ cents.

NEW YORK METAL MARKET PRICES

	Jan. 25, 1928 Cents per Pound	Feb. 1, 1928 Cents per Pound
Copper, electrolytic	14⅛	14⅛
Lead, Am. S. & R. price	6⅛	6⅛
Antimony	10¾	11¼
Nickel, ingot	35	35
Zinc spots	6	6
Tin, Straits	55⅛	54⅛
Aluminum, 99 per cent	24.30	24.30

Base copper wire price Feb. 1, 1928, 15⅛ cents.

Increased Buying Noted in Eastern District

There is a noticeable increase in buying in the Eastern district, with industrial business leading by a good margin. Indications point to heavy commitments in the early weeks ahead. Orders are comparatively small, but the continuous character of present business is rounding out excellent gross sales. Inquiries are increasing in volume. Sales of fractional-horsepower motors have increased in the past few days and marked improvement is expected to continue. Crane motors are advancing in call and a nitrogen company in the northern New York territory has placed orders for about $20,000 worth with a leading manufacturer. The sales tendencies in control apparatus are giving encouragement in the New York market. A prominent company in this line reports a government contract for battleships and for the Bureau of Ordinance totaling about $90,000. A sizable order also has been secured from a baking concern in the West. Industrial locomotives are in demand and a gas company in Brooklyn has purchased two such units from a leading maker, and there is other business of this kind in sight. Electric elevator sales are rising to decidedly higher levels and commitments in excess of $50,000 have been secured by a representative manufacturer covering a large warehouse and bank in the metropolitan district.

While central-station turbine business is curtailed, industrial interests are making purchases of smaller-sized units. A company at Rochester has placed a contract, aggregating $50,000, for apparatus of this kind. A leading manufacturer of wire and cable says that business is slow at the present time. Some promising wire inquiries, however, have been received from utility companies in the New York zone, and a few weeks hence is expected to show betterment in the situation. Instrument business is passing through a quiet period, although radio-frequency meters are selling well. An order has been received recently from the government for apparatus of the latter sort, totaling $20,000.

Construction activities include the following: McClellan & Junkersfeld, Inc., New York, will prepare plans for a plant for the Great Western Power Company near San Francisco, with initial capacity of 35,000 kw. The Niagara, Lockport & Ontario Power Company will build a steel-tower transmission line at Salamanca, N. Y. The Paul Smith's Power & Electric Corporation will build new transmission lines in Franklin and Clinton Counties. The Public Service Electric & Gas Company, Newark, N. J., has purchased 176 acres at West Orange, N. J., for transmission line right-of-way and a switching station. The Philadelphia Electric Company plans an addition to its substation at Westmoreland Street and Hunting Park Avenue. The Pennsylvania Power & Light Company will take over properties in Northumberland and Wayne Counties and plans transmission line extensions. The Pennsylvania Power Company, Sharon, has applied for permission to build a transmission line over the Mahoning River, near Mahoningtown, Ohio. The United States Engineer, Pittsburgh, plans a power house at Lock No. 6, Allegheny River, and will soon take bids. The General Purchasing Officer, Panama Canal, Washington, D. C., is asking bids until Feb. 10, for motor-driven air compressors (Panama Schedule 1856).

Inquiries and Orders Increase in the Southeast

Both inquiries and orders are on the increase in the Southeast and prospects for the next few months are very bright. The engineering contract for a two-million-dollar power plant in Texas has been let. The largest central-station order was from Alabama for varnished cambric cable amounting to approximately $50,000. The demand for distribution and small power transformers is active, with the orders coming from the territory generally. One company in Georgia ordered transformers to the extent of $8,300, while another company in the same state ordered transformers totaling $6,000. A Tennessee firm placed an order for distribution transformers amounting to $3,000 and a Florida company purchased distribution transformers totaling $1,500. Inquiries on transformer equipment are in much greater number than was the case this time last year. An interesting power company order was for $5,000 worth of watt-hour meters, while some other central-station orders were for cable and wire amounting to $3,100, arresters totaling $2,300 and small switches amounting to $2,000. One company ordered $1,200 worth of sign equipment.

Contracts were let last week on a textile mill addition involving $70,000 in electrical equipment and materials and an ice plant electrification calling for $10,000 worth of electrical materials. There is a new textile mill project for South Carolina, involving $30,000 worth of electrical equipment and materials,

that is now in the hands of engineers and construction contracts will be let within the next four weeks.

Construction projects are as follows: The Florida Power & Light Company will extend the street-lighting system at Sarasota, Fla., at a cost of $18,000. The Woodmere Lumber Company, Venice, Fla., plans rebuilding a mill recently destroyed by fire with loss of about $100,000. The Crisp County Power Commissioners, Cordele, Ga., plan a hydro-electric plant on the Flint River, to cost $1,200,000, with transmission lines. Lexington, N. C., plans extensions in its transmission system to cost about $20,000. The Duke Power Company plans a transmission line from Canton, N. C., to Greenville, S. C. The Virginia Public Service Company, Charlottesville, Va., plans transmission lines in Bedford and Amherst Counties. The Virginia-Carolina Soapstone Company, Roanoke, Va., plans a plant near West Jefferson, N. C., to cost about $300,000. Bonds to the amount of $1,250,000 are to be issued by Crisp County, the proceeds to be used for a hydro-electric power development on the Flint River at Warwick, Ga.

Industrial Conditions Improve in Middle West

Actual business placed in the Middle West justifies the optimism expressed at the beginning of the year. The first two weeks sales were not as good as the last two. It is apparent that a feeling of confidence in the future is manifested in most every business. Industrial conditions in the Calumet steel region were improved. The ninth blast furnace of the Gary works of the Illinois Steel Company was fired, giving employment to an additional 1,000 men. One of the large railroads placed an order for passenger cars, valued at $4,000,000, with a manufacturer in the Middle West.

The various utility companies are planning many extensions, additions and increases to service, buildings and distributing equipment. Among the interesting items ordered were: Three 500-kva. power transformers, ash pit overflow pump complete with appurtenances and ignition arches for six B. & W. boilers. Maintenance purchasing was quite large adding materially to the volume of business. Jobbers' sales have gradually increased, although the volume of business is not unusually large.

Construction projects are as follows: The Continental Ice Company, Chicago, Ill., will build an ice plant at Silvis, Ill., to cost $200,000. The Davenport Cement Company, Davenport, Iowa, plans a new mill at Buffalo, Iowa, to cost $1,350,000. The Cownie Tanning Company, Des Moines, Iowa, plans rebuilding of plant recently destroyed by fire with loss of $150,000. The Timken Roller Bearing Company, Canton, Ohio, plans a substation in connection with new plant units. The Cleveland Electric Illuminating Company, Cleveland, will build a substation on West Ninety-fifth Street, to cost about $100,000. Springfield, Ohio, plans an ornamental lighting system on Main Street. The Ice & Fuel Company, Youngstown, Ohio, plans an ice plant to cost $125,000. The Rhinelander Paper Company, Rhinelander, Wis., plans a new power plant. The Wisconsin Veneer Company, Rhinelander, Wis., plans rebuilding its mill recently destroyed by fire, to cost $100,000. The Wisconsin Electric Power Company will soon enlarge its Lakeside power plant, St. Francis, Wis., with installation of a 60,000-kw. turbo-generator unit.

Motor Sales Dominate in New England Market

Industrial equipment orders and inquiries were outstanding features in the electrical market in New England. Small motor sales gained and one manufacturer recorded a volume amounting to more than $40,000. Another company reports a demand for sizes ranging up to 50 hp. with textile and shoe factories considering replacements. Inquiries for turbo-generators of the lower ratings are being received by manufacturers. Power apparatus and control equipment sales are steady, with the demand on a par with last year. Industrial electric furnaces continue to attract attention. Electrically driven ice plants are being considered in the district. Projects in eastern Massachusetts are under way and one in Hartford, Conn., calls for an expenditure of about $100,000. Electric refrigerator sales are gaining and one central-station company recently placed 60 among its employees.

Central-station supplies are receiving little attention and distributors report spotty conditions. Orders for crossarms, weatherproof wire and line hardware are mounting, with railroads most active among buyers. The industrial situation in central Massachusetts is improving.

Construction projects are as follows: The Wilton Manufacturing Company, Maine, will add 60 looms to its weaving plant. The U.G.I. Company, Philadelphia, is making surveys in western Massachusetts for hydro-electric possibilities on the Konkapot River.

Business in St. Louis Shows Improvement

Conditions in St. Louis show improvement. One of the steel companies bought $30,000 worth of motors and control apparatus for two main roll drives. A contract for elevator motors for addition to a hotel amounted to $20,000, and electrical equipment for six new elevators in a department store cost $20,000. An order for auxiliary motors and equipment for a large power station in the western part of Missouri amounted to $52,000, and another order covered $30,000 worth of lamp globes. A good demand for conduit, wire and other construction materials is reported.

Construction projects in the district are as follows: The Joplin Realty Company, Joplin, Mo., heads a project to install an ornamental lighting system on Main Street. Kennett, Mo., plans a municipal lighting plant to cost about $25,000. St. Louis plans an appropriation of $2,500,000 for an ornamental lighting system in the downtown district. The H. D. Lee Flour Mills, Inc., Salina, Kan., plans rebuilding plant recently destroyed by fire with loss of $100,000. Picher, Okla., plans an improved lighting system in the downtown section. The Public Service Company of Oklahoma plans extensions in its ice plant at Grove, Okla., and will build a transmission line to that place from Alto, Okla., to operate at 11,000 volts. The Arkansas Cold Storage Company, Little Rock, plans a cold storage and refrigerating plant to cost about $100,000. The Arkansas Power & Light Company, Little Rock, will install an ornamental lighting system on Markham Street. Colorado, Tex., and Snyder, Tex., both plan a municipal power plant and ice plant. The Houston Lighting & Power Company, Houston, Tex., plans a new substation on Richmond Road. The Hildago Utilities Company, Hildago, Tex., plans a power and ice plant. The Travis Cottonseed Products Company, Austin, Tex., plans a plant at Corpus Christi, Tex., to cost about $200,000. The Louisiana Power & Light Company will build a transmission line from Magnolia to Haynesville, La.

Large Projects Reported on Pacific Coast

Large construction projects on the Pacific Coast include a soap plant for Long Beach at a cost of $700,000, two apartment houses for San Francisco, valued at $600,000 and $1,000,000 respectively, a can factory for San Francisco, and street lighting systems for Albany, Watsonville, and Suisun. San Jose has ordered thirty-four duplex standards totaling $10,000. Two huge power projects recently broached were one by the Pacific Gas & Electric Company for a 360,000-hp. unit on the south and middle forks of the Feather River, and another by the Great Western Power Company for a 35,000-kw. steam turbine plant in the India Basin of San Francisco. Small local power line orders are reported from Sacramento and Truckee, south San Francisco is in the market for a 40-box fire alarm system, and Glendale for four 200-amp feeder regulators. Power company orders include one carload of pole line hardware and two carloads of poles, also an inquiry for 1928 requirements of creosote, valued at about $30,000. Export orders include $6,500 worth of wire and wiring material for Mexico. Imports from the Far East were better during January than for the previous decade. Industrial orders include assorted oil well motors and transformers for the Kern oil fields, 2,500 ft. of submarine dredging cable and 3 250-hp. motors for a cement plant, and 72 lightning arresters for the Mt. Whitney area. Prices of conduit and loom boxes and of rubber-covered wire have decreased about 5 per cent and spe-

cial inducements are being offered on 1,000 lots of certain schedule staples, marking perhaps a tentative return to the larger units of ordering.

Transmission line projects and the letting of large contracts were features of business in the Puget Sound district. The Puget Sound Power & Light Company purchased $100,000 worth of transmission wire, $42,000 worth of insulators and pole line hardware and $21,000 worth of poles for 188 miles of heavy transmission line from Sedrowoolley to Seattle to be known as the Baker River line No. 2. The same company will shortly begin construction of a 16-mile transmission line from Wenatchee to Moses Coulee, opening up 7,500 acres of agricultural lands. The city of Tacoma has awarded contract for the special underground duct system at the Nisqually substation and has bought 18,000 lb. of copper transmission wire. Owing to changes in route necessitating new plans and specifications for the transmission line between Morton and La Grande, the date of opening of bids has been indefinitely postponed. Motor sales reported were light last week, and aggregated about 60 units from 100 hp. down.

Construction projects are as follows: The Pacific Fruit Express Company, San Francisco, plans erection of an ice and cold storage plant at Tucson, Ariz. at a cost of $400,000. The Auburn Fruit Exchange, Auburn, plans an ice and precooling plant to cost about $100,000. The Coast Counties Gas & Electric Company plans a new equipment storage and distributing plant at Hollister, to cost $35,000. The Water and Power Commission, Los Angeles, is asking bids until Feb. 28, for generators, exciter, transformers, hydraulic equipment and accessory electric apparatus. The Sacramento Pulp & Paper Company, Sacramento, plans a new mill to cost $400,000. The Illinois-Pacific Glass Company, San Francisco, plans a new plant at Vernon, Calif., to cost $750,000. The National Lumber & Creosoting Company, Texarkana, Ark., plans a plant at Utah Junction, near Denver, Col., to cost about $350,000. The Idaho Power Company plans a hydro-electric power plant on Snake River, near American Falls, Idaho, to cost $1,500,000, with transmission line. Sand Point, Idaho, plans a municipal hydro-electric plant on Priest River, to cost $166,000. The Glacier County Light & Power Company, Cut Bank, Mont., plans a power plant on Two Medicine River with transmission lines, to cost $400,000. Great Falls, Mont., will buy high-duty pumping equipment for waterworks service, to cost $35,000. The Southern Pacific Railroad Company will build a new addition to its locomotive and car shops at Eugene, Ore., to cost about $250,000. Morton, Wash., is asking bids until Feb. 20, for construction of a transmission line from power plant near Alder, with distributing systems at Morton and Mineral, Wash. Culver City, Fresno, Pittsburg, Richmond, Ukiah, and Willows, all of California, plan ornamental lighting systems.

Activities of the Trade

General Electric Sells Welding Equipment to Ford

In the past few months the Ford Motor Company has installed approximately 30 General Electric automatic arc welding equipments. Although this is considered a fair-sized automatic welding installation, it is understood that it is but a beginning of the automatic arc welding operations planned by the Ford company. The increasing use of welding in automobile manufacture is demonstrated by the fact that a large number of parts on the new Ford car are constructed by arc welding. Among these welded parts are the rear axle housing, the steering gear casing, the radius rod, the spare tire carrier, the drag link for the front axle and the axle rods. It is said that experiments are now under way preparatory to welding several other parts in addition to these.

Sterling Electric Motors Moves into New Plant

Recently organized in California, as announced in the Nov. 19, 1927, issue of the ELECTRICAL WORLD, Sterling Electric Motors, Inc., has moved into its new modern factory, located on Telegraph Road at Atlantic Boulevard, is installing most of its heavy machinery and expects to be in production early in February. The company will market the Sterling "Cros-Line" motor and will produce motors from ½ hp. to 30 hp.

Lighting Schools Will Study Electrical Advertising

Under the direction of C. J. Eaton, chairman of the advertising committee of the National Electric Light Association, the first electrical advertising school will be opened March 5-8 at the Edison Lighting Institute of the Edison Lamp Works of the General Electric Company at Harrison, N. J. Experts in the electrical advertising world, central station men, electrical sign manufacturers and engineers of other interested companies will give courses designed to inform the industry as a whole of the developments among its component parts. Industry problems will be discussed, individual developments explained, future possibilities pointed out, and improvements toward benefiting the whole suggested.

A second school offering similar courses will be held at the Nela School of Lighting of the National Lamp Works of the General Electric Company at Cleveland, Ohio, March 19-22. The Westinghouse Lamp Company is co-operating with the General Electric Company under the committee on electrical advertising of the N.E.L.A. in both of these schools. Registration for the Harrison school should be made through A. D. Bell, Edison Lighting Institute, Harrison, N. J., or through J. J. McLaughlin, Westinghouse Lamp Company, Bloomfield, N. J., no later than February 27. Names of those planning to attend the course at Cleveland should be sent to L. C. Kent, Nela School of Lighting, Nela Park, Cleveland, or to J. J. McLaughlin, Westinghouse Lamp Company, Bloomfield, N. J., not later than March 12.

Fire-Fighting Equipment Demonstrated

An exhibition and demonstration of the Phomene accumulator system of fire-fighting equipment was given in Newark, N. J., by the Globe Automatic Sprinkler Company, and the Pyrene Manufacturing Company on the afternoon of Jan. 19. The most spectacular part of the demonstration was the 30-ft. tank of oil which was ignited and allowed to burn for about ten minutes. Then the fire-fighting equipment was brought into action, and in two or three minutes a blanket of foam was formed over the oil and completely extinguished the fire. Although the other fires were not as spectacular as the oil tank, the efficiency with which they were handled indicated the effectiveness of the system.

The Phomene accumulator system consists of a tank containing a white powder which is connected to the water system, through an automatic valve, and to the object to be protected. When the water is turned into the powder a foam forms and flows through a foam-distribution system, over the object on fire. The fire is extinguished by the foam blanket excluding the air from the combustible material. Various methods may be employed for making the system automatic, such as sprinkler heads and thermostatic devices.

Northern White Cedar Association Holds Meeting

A large and successful meeting was held by the Northern White Cedar Association this week at Minneapolis. It was the sense of the meeting that producers' facilities are in better shape than ever, and the high spot of the discussion centered around the promotion of the best service to customers. An attendance larger than at any previous meeting was recorded at the banquet on Tuesday evening. The new officers elected are: Guy Ramsey, president; Wilbur Lafean, vice-president; H. S. Gilke, treasurer, and N. E. Boucher, secretary. The board of directors includes L. A. Page, J. E. Gerich, Donald Bell and John Twomey.

THE PEERLESS ELECTRIC COMPANY, Warren, Ohio, announces that John M. Tuthill has been appointed general sales manager of the company. Mr. Tuthill, recently of Philadelphia, was formerly with the Niagara Falls Power Company. Phil F. Toman will be sales manager of the motor division of the company and will devote all his attention to that phase of the business.

THE INSULATION MANUFACTURING COMPANY, INC., is moving from 70 Washington Street, Brooklyn, to New York Avenue and Herkimer Street, Brooklyn, where 50 per cent more manufacturing space is available. Together with the General Insulate Company, which was acquired by the Insulation Manufacturing Company early last year, the products manufactured are "bakelite," molded parts for many electrical applications and insulators, including its trade marked goods "Electrose" and "Insulate."

THE MASTER ELECTRIC COMPANY, Linden and Master Avenues, Dayton, Ohio, held its annual sales convention at its plant last month.

THE ELECTRO-KOLD CORPORATION, Spokane, Wash., early in December elected L. M. Simpson president and general manager. Mr. Simpson succeeds as president Dr. X. L. Anthony, who has become chairman of the board of directors, and C. L. Lewis, formerly general manager, who has resigned to take care of personal affairs.

THE CONDUO-BASE COMPANY, 2345 Carnegie Avenue, Cleveland, announces the development of its "Junior Conduo-Base" for the wiring of buildings. The United Metal Products Company, Canton, Ohio, and the Dahlstrom Metallic Door Company, Jamestown, N. Y., are licensed manufacturers.

PORTER & ROSS, INC., 30 Church Street, New York, manufacturers' agents, announce the opening of branch offices at the Monadnock Building, Chicago, 839 Oliver Building, Pittsburgh, and 1002 Louderman Building, St. Louis.

THE C. H. WHEELER MANUFACTURING COMPANY, Philadelphia, manufacturer of condensers, pumps and cooling towers, announces that the Reeves & Skinner Machinery Company of St. Louis and Kansas City has been appointed agent for those territories.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., announces the opening of its Boston sales office in the Statler Building, room 1002. J. S. Ingebretsen is in charge of the office. The company also announces the appointment of Frank M. Buckley as sales representative in the Pittsburgh district. He will work this year with A. H. Bergendahl, the present salesman.

THE R. H. BEAUMONT COMPANY, 319 Arch Street, Philadelphia, Pa., manufacturer of skip hoists, cable drag scrapers, etc., announces that L. O. Hassler, formerly chief engineer, has been transferred to its Western headquarters at the Strauss Building, Chicago, and he will devote himself to sales in the Chicago territory under the direction of H. E. Birch. The company also announces that William P. Alexander, who resigned from the organization in May of last year, has returned to the sales department and will devote himself to sales duties in the Philadelphia, Baltimore and Washington district.

THE DANIEL WOODHEAD COMPANY, Chicago, has placed on the market the "Protex" rubber-handled portable extension lamp and the "Vaprotex" vapor-proof portable extension lamp.

THE ROME WIRE COMPANY, Rome, N. Y., a division of the General Cable Corporation, announces the appointment of Jenkins & Gunther, Unit 2, Santa Fe Building, Dallas, Tex., as sales agents. The territory covered will include the states of Texas, Arkansas, Oklahoma and western Louisiana.

THE NATIONAL-HARRIS WIRE COMPANY, Newark, N. J., has leased for ten years, with option to purchase the Heller Brothers' file works at Mount Prospect and Verona Avenues. Paul Heller will become actively associated with the company.

New Equipment Available

Thermostat and Relay

An electric immersion thermostat suitable for maintaining liquid temperatures within a range of plus or minus 5 deg. F. has been added to the line of temperature control equipment of the Wilcolator Company, 17 Nevada Street, Newark, N. J. It is supplied in three ranges of temperatures: 50 to 150 deg. F.; 100 to 300 deg. F., and 250 to 550 deg. F. The unit has a bulb immersion of 2⅜ in. and is threaded for ½-in. standard pipe. Three wire control is used through a relay, the terminals are arranged for open wiring, armored cable or conduit connection, and the maximum voltage is 250. Calibration is secured by removing the cover and moving the adjustment lever to the desired temperature to be maintained. Its application is particularly well suited to electric water heaters, urns, sterilizers and similar apparatus requiring close temperature control.

A relay also has been designed particularly for three-wire control through thermostats or other pilot means and is built for alternating current only with a rating of 110 volts, 25 or 60 cycles, 30 amp. or 220 volts, 60 cycles, 15 amp. It is designed for non-inductive circuits only and in operation it is said to be particularly quiet.

INDOOR BUS SUPPORT.—A new line of low-voltage indoor bus supports which embody complete interchangeable features has been placed on the market by the Line Material Company, South Milwaukee, Wis. The line embodies a variety of types for mounting buses either vertically or horizontally and on any type of structure as well as for mounting round buses. The bus supports are available for 750-volt and 2,300-volt service.

PORTABLE TINNING POT.—A portable tinning pot has been added to the line of electric heating equipment of the General Electric Company. It is used for small tinning and soldering operations. It is built on the same principle as the larger melting pots made by the company. The heating unit, which is of the cartridge type, dissipates 150 watts. This pot is particularly designed for solder and tin, having a maximum operating temperature of 500 deg. F. About 15 minutes only are required to reduce the full contents of the pot to working temperature. While the pot is normally designed for operation on 110-volt circuits, it can be supplied for operation on 100-, 120-, or 240-volt circuits if desired. It has an approximate shipping weight of 6 lb.

Multiple Duct Slant Conduit

A multiple duct slant conduit especially adapted for building curves of various radii has been developed by the National Fire Proofing Company, Pittsburgh, manufacturer of "Natco" underground clay conduit, with the assistance and co-operation of the Bell Telephone Laboratories, New York. These slant conduits have been made and used for some years in the single duct shapes but this idea has now been applied to various multiple duct shapes including 2, 3, 4, 6 and 9-way. These multiple duct slants used alone or in combination with the straight short pieces of the same multiple may be used in building curves from 10 ft. to 25 ft. radius as well as in various angles such as 15, 22½, 30, 45, 60 and 90 deg.

RECORDING THERMOMETER.—A 72-hour recording thermometer 6 in. in diameter by 3¾ in. high has been placed on the market by the Bristol Company, Waterbury, Conn. The instrument is useful in obtaining data on commercial and residential installations before and after electrical units are placed in service. It is drum-shaped, without tubes or cables, and has a range of from 30 to 70 deg. F. It may be placed flat or hung on a hook. As a central-station sales department adjunct it is designed to eliminate many causes of argument over temperature conditions in prospective customers' apparatus and to aid in the adjustment of new installations to local service conditions.

Electrical Patents

Announced by U. S. Patent Office

(Issued Jan. 3, 1928)

1,655,035. REGULATING SYSTEM; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Jan. 17, 1925.

1,655,036. CONTROL OF ELECTRIC POWER; E. F. W. Alexanderson and A. H. Mittag, Schenectady, N. Y. App. filed April 25, 1925.

1,655,037. LOCOMOTIVE CONTROL; E. F. W. Alexanderson, Schenectady, N. Y. App. filed May 25, 1925.

1,655,038. POWER-FACTOR-CONTROL SYSTEM; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Aug. 5, 1925.

1,655,040. CONTROL OF ELECTRIC POWER; E. F. W. Alexanderson and A. H. Mittag, Schenectady, N. Y. App. filed Dec. 15, 1925.

1,655,041. REGULATING APPARATUS; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Jan. 15, 1926.

1,655,042. SPEED-CONTROL SYSTEM; E. F. W. Alexanderson, Schenectady, N. Y. App. filed July 14, 1926.

1,655,050. SEALING-IN MACHINE FOR TUBES AND BULBS; C. Eisler, Newark, N. J. App. filed April 25, 1925.

1,655,051. MACHINE FOR MAKING STEMS FOR INCANDESCENT LAMPS; C. Eisler, Newark, N. J. App. filed July 1, 1926.

1,655,087. SHADE MOUNTING; A. Bostroem, Roselle, N. J. App. filed July 24, 1924. For portable desk lamp.

1,655,102. LIGHTING FIXTURE; V. G. Kay, Cleveland, Ohio. App. filed Jan. 20, 1926.

1,655,106. ELECTRICAL CONDUCTOR; C. A. Parsons, J. Rosen, A. W. Grey and B. Blair, Newcastle-on-Tyne, England. App. filed Nov. 9, 1925. Of a flat, elongated form suitable for the slot windings of dynamo-electric machines.

1,655,119. PROTECTED THERMOMETRIC ELECTRIC CIRCUIT CLOSER; E. B. Wilson, East Orange, N. J. App. filed Feb. 18, 1927.

1,655,142. ELEVATOR SIGNALING SYSTEM; R. H. Gaylord, Los Angeles, Calif. App. filed March 26, 1925.

(Issued Jan. 10, 1928)

1,655,404. OUTLET BOX COVER; A. J. Bassett, Brooklyn, N. Y. App. filed Feb. 7, 1921.

1,655,405. ELECTRICAL CONNECTER; H. W. Batcheller, Bethel, Vt. App. filed Aug. 1, 1924. Comprising a socket provided with internal conducting members adapted to connect the lamp, which is placed at one end of the socket with a conducting cable at the opposite end.

1,655,408. GOVERNOR-OPERATED SWITCH; J. E. Boyce, Yonkers, N. Y. App. filed Sept. 29, 1923.

1,655,413. ELECTRIC WATER HEATER; E. L. Emerson, Braintree, Mass. App. filed Dec. 15, 1921.

1,655,430. ELECTRIC CIRCUIT-CLOSING MEANS; H. L. Merrick, Passaic, N. J. App. filed May 10, 1924. For use in connection with balances and automatic weighing mechanism.

1,655,451. ELECTRIC CURRENT REGULATOR; C. S. Agate and A. E. Hill, Chelmsford, England. App. filed Aug. 8, 1922.

1,655,453. ELECTROMAGNET; H. W. Brown, Schenectady, N. Y. App. filed May 15, 1923.

1,655,464. ELECTRIC SWITCH; H. J. H. Huber, Schenectady, N. Y. App. filed April 10, 1922. Oil switch.

1,655,465. GROUNDING AND TESTING ARRANGEMENT; H. J. H. Huber, Schenectady, N. Y. App. filed March 10, 1926.

1,655,466. METHOD AND APPARATUS FOR TREATING FILAMENTS; G. E. Inman, East Cleveland, Ohio. App. filed June 9, 1926.

1,655,469. POWER SYSTEM; C. MacMillan, Schenectady, N. Y. App. filed April 27, 1923. In which a plurality of prime movers such as Diesel engines or steam turbines are utilized to drive the generators which supply power to the propeller motor.

1,655,470. ELECTRIC SHIP PROPULSION; C. MacMillan, Schenectady, N. Y. App. filed March 21, 1924.

1,655,475. ELECTRIC SYSTEM; D. C. Prince, Schenectady, N. Y. App. filed Aug. 12, 1925. Wherein current transmitted between direct and alternating-current circuits is rectified or derectified by an electric valve apparatus.

1,655,479. ELECTRIC HEATER; H. E. Strunk, Ontario, Cal. App. filed Jan. 16, 1924. Means for protecting from overheating, particularly for electric flatirons.

1,655,480. ELECTRIC HEATER; R. L. Uhl, Ontario, Cal. App. filed Jan. 3, 1923. Means for protecting electric heaters from overheating.

1,655,488. ELECTRIC INCANDESCENT LAMP; H. Wolff, F. Koref and F. Skaupy, Berlin, Germany. App. filed Nov. 3, 1925.

1,655,492. KILOVOLT - AMPERE - DEMAND METER; H. J. Blakeslee, West Hartford, Conn. App. filed Feb. 9, 1924.

1,655,493. SECONDARY ELECTRIC CLOCK; T. S. Casner, Plainfield, N. J. App. filed Sept. 6, 1924.

1,655,502. INCANDESCENT ELECTRIC LAMP; G. Holst, Eindhoven, Netherlands. App. filed March 11, 1927. In which the absorption of light is reduced by means of a substance usually called a "getter."

1,655,528. ELECTRIC IGNITION SYSTEM FOR GAS BURNERS; E. T. Banzhaf, San Francisco, Cal. App. filed Dec. 6, 1922.

1,655,540. MOTH EXTERMINATOR; A. C. Friedel, Syracuse, N. Y. App. filed Jan. 29, 1927.

1,655,554. DEVICE FOR ELECTRIC THERAPEUTIC TREATMENT; J. A. Lev, Peoria, Ill. App. filed May 8, 1926.

1,655,590. AUTOMATIC TRAFFIC SIGNAL; H. J. Borgerding and J. F. Borgerding, Oakland, Cal. App. filed March 20, 1924. For directing traffic at the intersections of highways or streets.

1,655,598. BATTERY TERMINAL CONNECTER; S. Diller, Des Moines, Iowa. App. filed Oct. 18, 1926.

1,655,604. ELECTRICITY METER; J. Harris, Lafayette, Ind. App. filed Jan. 22, 1926. Means for causing such a meter to operate accurately over a wide load range.

1,655,663. REGULATOR SYSTEM; H. W. Rogers and E. H. Horstkotte, Schenectady, N. Y. App. filed Feb. 13, 1926. For segregated drives such as paper-machine drives.

1,655,665. ELECTRIC WAFFLE IRON; J. L. Shroyer, Oak Park, Ill. App. filed Aug. 2, 1926.

1,655,694. ELECTRIC SWITCH; F. Gropp, Berlin, and M. Butterlin, Neubabelsberg, Germany. App. filed Jan. 6, 1927. Fluid-break type.

1,655,706. CABLE SPLICE; E. C. Kirk, St. Albans, W. Va. App. filed April 25, 1923.

1,655,708. STAND FOR ELECTRIC FLATIRONS; C. L. Moyer, Chicago, Ill. App. filed Nov. 30, 1925.

1,655,717. BRUSH FOR SMALL MOTORS AND DYNAMOS; R. H. Wappler, Yonkers, N. Y. App. filed May 27, 1924.

1,655,720. HEATING UNIT AND METHOD OF MAKING SAME; H. A. Ziola, Toledo, Ohio. App. filed March 28, 1925.

1,655,746. ELECTRIC BOUDOIR LAMP; C. Wachtel, New Hyde Park, N. Y. App. filed Jan. 16, 1925.

1,655,760. TIMING DEVICE; H. F. Delmanhorst, Louisville, Ky. App. filed Sept. 29, 1925. Employed in automatically operating varicolored lights as at street crossings.

1,655,761. ELECTRIC INCANDESCENT LAMP; P. Duffy, San Francisco, Calif. App. filed April 2, 1927. Adapted for electrotherapeutical, general lighting and automobile headlight uses.

1,655,781. APPARATUS FOR ELECTROPLATING; G. Caraccio, Genoa, Italy. App. filed Aug. 3, 1926.

1,655,783. ELECTRODE FOR THE COMBINED THERAPEUTIC APPLICATION OF HIGH-FREQUENCY CURRENT AND OF ULTRA-VIOLET RADIATION; R. Gallois, Lyons, France. App. filed Sept. 14, 1926.

1,655,824. MOTOR CONSTRUCTION HAVING COOLING-OIL CIRCULATION; B. F. Schmidt, Los Angeles, Calif. App. filed Sept. 30, 1925.

1,655,834. ELECTRIC RAIN SWITCH; F. Dzierzenga, Brooklyn, N. Y. App. filed Sept. 20, 1926. Switches provided with means to collect raindrops, the weight of the collected rain water causing the switch to close the electric circuit.

1,655,837. SUBWAY TRANSFORMER; S. Horelick, Pittsburgh, Pa. App. filed Dec. 17, 1925.

1,655,838. ELECTRICAL HEATER ELEMENT; E. C. Lackland, New Haven, Conn. App. filed May 7, 1924.

1,655,842. FUSE; E. F. Pelletier, St. Joseph, and W. Bandlow, Benton Harbor, Mich. App. filed Sept. 10, 1925. With means for visibly indicating fusing of the fusible element.

1,655,857. METHOD OF AND ELEMENT FOR HEATING HOVERS; H. O. Cunard, Modesto, Calif. App. filed May 13, 1925.

1,655,892. INSULATOR; B. E. Colburn, Green Bay, Wis. App. filed June 30, 1926. For radio antennas.

1,655,928. CIRCUIT CONTROLLER; H. N. Wade, Milwaukee, Wis. App. filed July 19, 1919. Applicable to the control of polyphase circuits for effecting automatic interruption under conditions of phase failure or phase reversal or upon predetermined reduction of the line voltage.

1,655,929. ELECTRICAL CONNECTING AND SUPPORTING DEVICE; E. C. White, New York, N. Y. App. filed April 28, 1923. For fixtures.

1,655,930, 1,655,931. OIL-REFINING STILL AND METHOD OF MAKING THE SAME BY ELECTRIC ARC WELDING; W. F. Woolard, Wauwatosa, Wis. Apps. filed Feb. 27, and March 13, 1926.

1,655,952. SYSTEM AND METHOD OF COMMUTATION FOR FREQUENCY CHANGERS; R. E. Hellmund, Swissvale, Pa. App. filed April 18, 1922.

1,655,965. IMPULSE STARTER FOR MAGNETOS; S. D. Livingston, Freeport, N. Y. App. filed April 1, 1926.

1,655,966. ARC INCANDESCENT LAMP; C. F. Lorenz, East Orange, N. J. App. filed March 14, 1923.

1,655,967. THERMAL RELAY; H. D. Matthews, Mansfield, Ohio. App. filed Nov. 21, 1925.

1,655,972. LIGHTNING ARRESTER; S. M. Pineles, Pittsburgh, Pa. App. filed Feb. 23, 1922.

1,655,983. INDUCTION FURNACE; P. H. Brace, Wilkinsburg, Pa. App. filed April 2, 1927.

1,656,013. ELECTRICAL MEASURING INSTRUMENT; R. T. Pierce, East Pittsburgh, Pa. App. filed Jan. 30, 1923. With means for limiting the movement of the index or pointer members.

1,656,052. TERMINAL CONNECTER FOR TOY RAILWAYS; A. R. Fergusson, Buffalo, N. Y. App. filed Sept. 27, 1922.

1,656,066. DRY CELL; W. F. Hendry, Ossining, N. Y. App. filed Jan. 23, 1924.

1,656,091. DEPOLARIZING MIX FOR DRY CELLS; V. Yngve, South Orange, N. J. App. filed March 24, 1924.

1,656,116. ELECTRICAL MEASURING INSTRUMENT; W. E. Hull, Sharpesville, Pa. App. filed April 14, 1926. For measuring the ohmic resistance of any given conducting element.

1,656,121. REFILLABLE ELECTRIC FUSE; F. C. La Mar, Pittsburgh, Pa. App. filed Dec. 1, 1924.

1,656,142. ELECTRIC HAIR WAVER; S. Cocroft, New York, N. Y. App. filed Aug. 28, 1926.

1,656,151, 1,656,152. ELECTRIC SWITCH; G. B. Thomas, Bridgeport, Conn. Apps. filed Oct. 28, 1920, and Feb. 4, 1922. Mechanically operated switch associated with an automatic actuating mechanism of any suitable sort, connected, for instance, with the mechanism of a washing machine.

(Issued Jan. 17, 1928)

16,851 (reissue). SWITCH; H. D. James, Edgewood, Pa. App. filed Feb. 20, 1920. Electromagnetic switch of the "lockout" type.

1,656,174. BRAKING MECHANISM; A. C. Dahl, Hinsdale, Ill. App. filed June 30, 1926. For motor driven apparatus.

1,656,188. ELECTRIC SWITCH; F. Favarger, Neuchatel, Switzerland. App. filed Feb. 19, 1926. Quick make and break.

1,656,203. ELECTRIC STORAGE APPARATUS; P. Kapitza, Chesterton, England. App. filed Aug. 26, 1924. "Flash" discharge accumulator.

1,656,247. ARC REGULATOR; H. H. Strong, Toledo, Ohio. App. filed Jan. 18, 1926. For effecting and regulating the feed of the electrodes of the arc of a motion-picture projector.

1,656,274. ELECTRIC-WELDING APPARATUS; H. S. Holmes, New York, N. Y. App. filed Feb. 9, 1925.

1,656,313. CONTROL SYSTEM; H. L. Blood, North Plainfield, N. J., and R. C. Deale, Plainfield, N. J. App. filed Nov. 19, 1923. For operating machine tools.

1,656,321. PROTECTION OF LAMP CONTROLLERS; E. Dick, Geneva, Switzerland. App. filed May 5, 1924. For train-lighting systems.

1,656,329. HIGH-TENSION CABLE ADAPTED FOR SMALL CURRENTS; E. G. Sievert and H. Svensson, Sundyberg, near Stockholm, Sweden. App. filed Nov. 11, 1925. As used in Röntgen-ray apparatus.

1,656,383. SAFETY SWITCH; W. E. McCoy, New York, N. Y. App. filed May 4, 1920. With switching means for entirely disconnecting the fuses from the circuits when the switch is opened.

1,656,395. TERMINAL; A. B. Saurman, Pittsburgh, Pa. App. filed Dec. 17, 1924. Used in the installation of electrical service lines.

1,656,399. ELECTRICAL SWITCH; A. G. Steinmayer, Milwaukee, Wis. App. filed July 31, 1924. Quick-break cut-out switch.

1,656,407. SWITCH MECHANISM; P. F. Williams and J. Rah, Chicago, Ill. App. filed June 25, 1926. Junction box with disconnecting pothead.

1,656,421. HEAT-BALANCE SYSTEM; C. W. Clarke, New York, N. Y. App. filed July 16, 1923. In steam-driven, power generating plants.

1,656,458. ELECTROMAGNET CONSTRUCTION; L. J. Wahl, Sterling, Ill. App. filed Sept. 25, 1925. Adapted for use in restricted space.

1,656,510. ELECTRIC FURNACE FOR MELTING OR PRODUCING GLASS, WATER-GLASS, CEMENT, OR OTHER SUBSTANCES; C. F. Cornelius, Stockholm, Sweden. App. field Feb. 26, 1926.

1,656,518. ELECTRIC WATER HEATER; W. J. Hammers, Grand Rapids, Mich. App. filed Aug. 23, 1926. Induction type.

1,656,689. TRAIN-SIGNAL SYSTEM; W. E. Benn and G. E. Davies, Troy, N. Y. App. filed May 10, 1920.

1,656,690. HEAT PENCIL; G. W. Blackburn, Elgin, Ill. App. filed Sept. 7, 1926. For making marks on paper, fabric or the like by charring or burning the fabric.

1,656,703. ELECTRIC SWITCH; B. E. Getchell, Plainville, Conn. App. filed Sept. 4, 1926. With means for preventing the formation of an injurious arc in the opening movement of the switch and for snuffing out such minor arcing as may form.

1,656,709. ELECTRIC OVEN; S. L. Kelly, Toledo, Ohio. App. filed Jan. 27, 1927.

1,656,725. CLUSTER OUTLET FOR ELECTRIC LAMPS; F. Chadwick, Hamilton, Ontario, Canada. App. filed Dec. 10, 1926.

1,656,729. LAMP-BULB HOLDER; C. E. Godley, Detroit, Mich. App. filed Jan. 25, 1926.

1,656,750. ROAD SWITCH FOR ELECTRIC GARAGE DOORS; R. V. Morse, Ithaca, N. Y. App. filed April 25, 1925.

1,656,753. STORAGE BATTERY; P. E. Norris, Wilkinsburg, Pa. App. filed Nov. 17, 1924.

1,656,768. TESTING DEVICE FOR ELECTRIC WIRING SYSTEMS; S. B. Berkowich, Baltimore, Md. App. filed Jan. 8, 1927.

1,656,777. COMBINATION HEAT AND LIGHT THERAPY LAMP; H. Dennis, New York, N. Y. App. filed Nov. 6, 1924.

1,656,792. ROSETTE; C. A. Jameson, Franklin, Neb. App. filed Sept. 30, 1925.

1,656,793. ELECTRIC BULB; F. K. Kayte, Farr, Col. App. filed Oct. 27, 1924.

1,656,797. SPLICER FOR POWER LINES; J. D. Scott, Curfew, Ky. App. filed May 26, 1926.

1,656,800. ELECTRIC CUT-OUT AND FUSE; W. J. Turenne, Danvers, Mass. App. filed Oct. 6, 1922.

1,656,837. CIRCUIT BREAKER; H. F. Smith, Dayton, Ohio. App. filed April 21, 1924. Which will break the circuit without producing objectionable arcing at the contacts.

1,656,851. CIRCUIT BREAKER; C. E. Anderson, Stratford, Conn., and W. H. Keefe, Jr., Bridgeport, Conn. App. filed June 24, 1925. Thermostatically controlled.

1,656,856. ELECTRIC APPLIANCE HAVING PIN CONTACTS AND METHOD OF MANUFACTURING THE SAME; W. J. Gagnon, Bridgeport, Conn. App. filed Dec. 20, 1926.

New Trade Literature

OVERHEAD CONSTRUCTION MATERIALS.—The Copperweld Steel Company, Glassport, Pa., is distributing a leaflet containing data on Copperweld non-rusting construction materials for overhead lines (wood-pole construction).

RECORDING THERMOMETER. — The Bristol Company, Waterbury, Conn., is distributing bulletin No. 363 describing its new small-sized Bristol recording thermometer.

ELECTRICAL SUPPLIES. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing its large complete catalog of electrical supplies for 1928-1930, containing 1,171 pages. It is a complete and up-to-date reference book of the electrical supplies made by the company and describes and illustrates the material.

CONNECTORS.—A bulletin issued by the Burndy Engineering Company, Inc., 10 East Forty-third Street, New York City, describes and illustrates the Burndy outdoor connectors equipped with "Everdur" parts.

ARC WELDING AND OUTDOOR STATION EQUIPMENT.—The General Electric Company, Schenectady, N. Y., is distributing bulletin No. GEA-823 covering its atomic hydrogen arc welding equipment for hand welding on 60-cycle circuits and bulletin No. GEA-460 B describing its types TA-1, TA-2, TA-5 and TA-6 horn-gap and disconnecting switches for outdoor station equipment.

TIME RECORDER.—Bulletin No. 1127 issued by the Esterline-Angus Company, Indianapolis, Ind., covers its new time recorder, an instrument for recording the time and duration of events.

EXCAVATOR AND CRANES. — The Harnischfeger Corporation, Milwaukee, has issued bulletin GH-2, covering its model 200 "P&H groundhog" for use as a shovel, dragline, clamshell crane, skimmer-scoop or trench-hoe. The company is also distributing bulletin 650-X describing the "P&H" model 206B excavator cranes.

TELEPHONE SYSTEMS.—Catalog No. 1110 issued by the Federal Telephone Manufacturing Corporation, Buffalo, N. Y., covers its complete line of interior private telephone systems and switchboards for apartment houses, schools, offices, industrial plants, residences, hospitals, etc.

LIGHTING FIXTURES. — The Artistic Lighting Equipment Association, 420 Lexington Avenue, New York City, has issued a booklet describing its sales promotion and refixturing campaign.

TRUCK AND TRAILER CRANES.—Bulletin No. 639-X issued by the Harnischfeger Corporation, Milwaukee, describes and illustrates its model 203-A "P&H" truck and trailer cranes.

PROTECTIVE PRODUCTS.—The Colt's Patent Fire Arms Manufacturing Company, Hartford, Conn., has isued catalog No. 56, covering the "Noark" meter service and safety switches, fuses, service and fuse boxes, underground boxes and fittings, and molded products and line material. The company is also distributing a miniature, pocket size reproduction of this catalog, which contains the switch and fuse sections only.

BLOWER. — A bulletin issued by the National Flue Cleaner Company, Inc., Groveville, N. J., describes the National soot blower.

CRANES. — The Whiting Corporation, Harvey, Ill., has issued catalog No. 209, superseding No. 200, covering its complete line of cranes. This catalog contains many illustrations of crane installations.

BALL AND ROLLER BEARINGS.—The Timken Roller Bearing Company, Canton, Ohio, has issued a booklet entitled "The Truth About Anti-Friction Bearings," discussing their design, their function, their necessity and their performance.

RESISTORS.—Bulletin No. 111 issued by the Monitor Controller Company, Baltimore, Md., describes and illustrates the Monitor edgewound, hexwound and smooth-wound resistors.

MOTORS AND CONTROL. — Bulletin GEA-761A, GEA-891, GEA-892, GEA-893 and GEA-910 issued by the General Electric Company, Schenectady, N. Y., describes and illustrate respectively, the improved brush holders for GE-57 railway motors, motors and control for ventilating fans in coal and metal mines, G-E motor drives for centrifugal pumps in coal and metal mines, geared induction-motor type electric drive for coal and ore hoists and the proper method of removing and replacing pinions for type HM industrial haulage motors.

LIGHTING EQUIPMENT.—The Lightolier Company, 569 Broadway, New York City, has issued a new catalog entitled "How to Make a Profitable Retail Fixture Sale."

FANS.—"New Sales Helps for Your 1928 Fan Business" is the title of catalog No. 1363 issued by the Robbins & Myers Company, Springfield, Ohio. It contains booklets and folders for distribution, photographic display signs, etc.

LIGHTNING ARRESTERS.—Booklet No. 245 issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, covers its Keystone crystal valve lightning arresters. Illustrations are given showing typical installations of the arresters.

ELECTRIC DRIVE FOR MOTOR BUSES.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-855 entitled "The Application of Electric Drive to Motor Buses," in which it gives illustrations of buses equipped with the G-E electric drive.

CONDUIT.—The National Fire Proofing Company, Pittsburgh, is distributing a pamphlet covering the "Natco" underground clay conduit of various shapes and sizes.

HIGH-POTENTIAL FUSES. — Bulletin 200A issued by Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, describes and illustrates the S & C high-potential fuse for 2,200-volt to 132,000-volt service in capacities from ½ amp. to 400 amp. In addition to ordering information covering ratings, dimensions, weights, etc., a number of important subjects are discussed as the S & C fuse and its relation to electric power systems, the S & C fuse and the requirements for interrupting high-voltage circuits, the S & C fuse and the fundamentals of fuse design, how the S & C fuse operates, application recommendations, etc.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Breslau, Germany (No. 29,255), of storage batteries.

Purchase is desired in Lille, France (No. 29,272), of wooden battery separators and battery parts.

Purchase and agency are desired in Glasgow, Scotland (No. 29,327), for electrical appliances such as switches, lamp fittings, and wiring supplies.

Purchase and agency are desired in Vienna, Austria (No. 29,283), for household electrical appliances.

Purchase is desired in Toronto, Canada (No. 29,280), of household electrical appliance parts for assembling.

Purchase or agency is desired in Toronto, Canada (No. 29,279), for quartz ultraviolet ray lamps or quartz burners for such lamps.

An agency is desired in Konstanz, Germany (No. 29,340), for electrical machinery.

Purchase and agency are desired in Durban, South Africa (No. 29,326), for electrical machinery and wiring supplies.

Purchase is desired in Madrid, Spain (No. 29,278), of electric refrigerators and electric vacuum cleans and floor waxers.

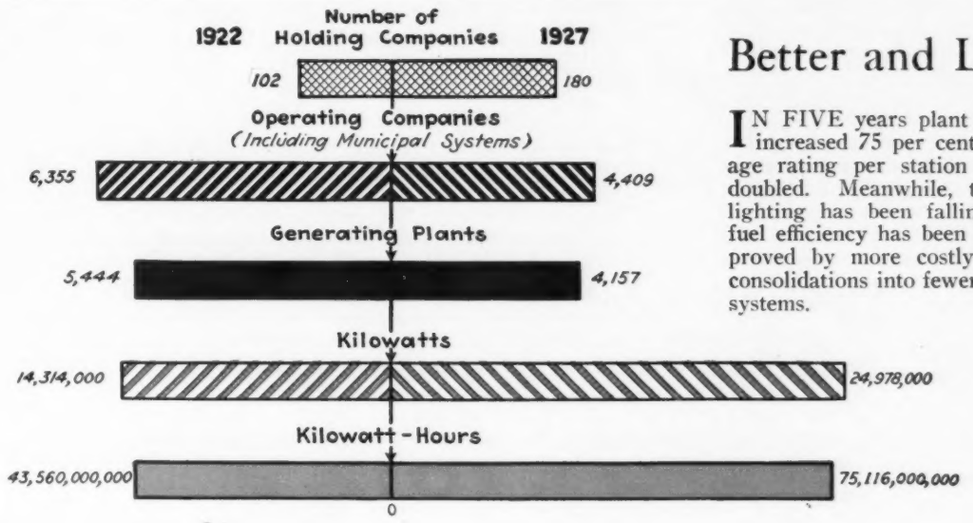
Purchase is desired in Magdeburg, Germany (No. 29,274), of electric vacuum cleaners.

Purchase is desired in Delitzsch, Germany (No. 29,275), of electric vacuum cleaners.

Purchase is desired in Leipzig, Germany (No. 29,276), and another (No. 29,277), of electric vacuum cleaners and floor polishers.

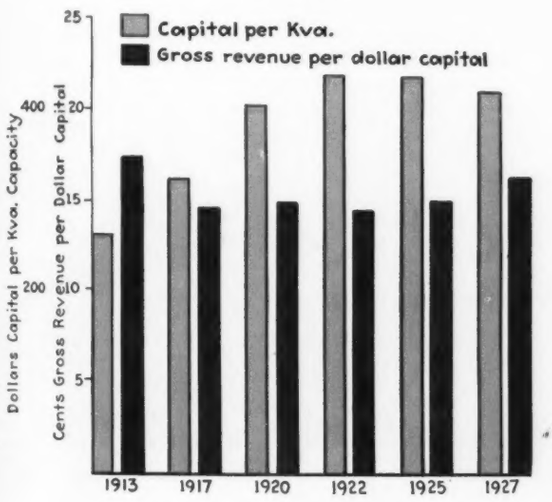
Business Facts for Electrical Men

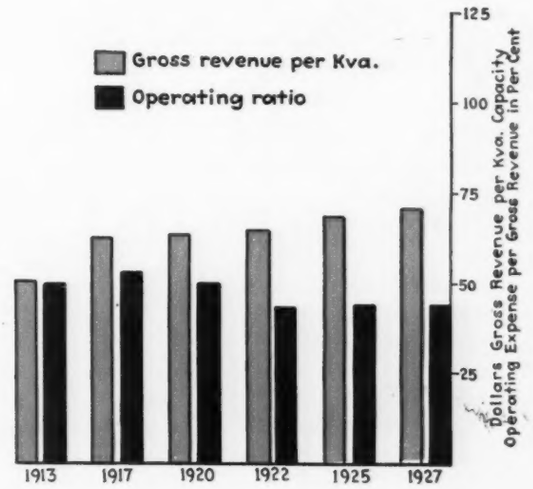
Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

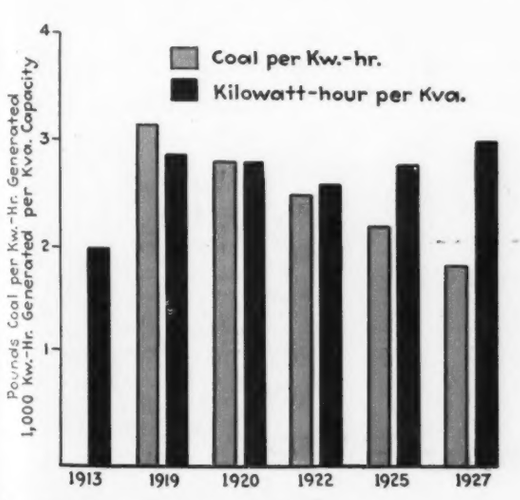


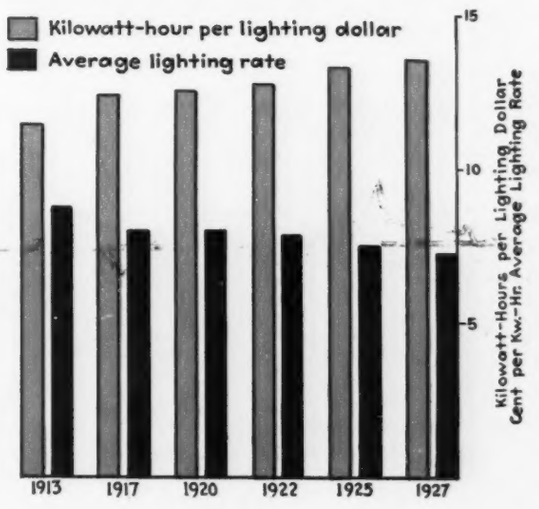
Better and Larger

IN FIVE years plant and output increased 75 per cent; the average rating per station more than doubled. Meanwhile, the cost of lighting has been falling steadily; fuel efficiency has been greatly improved by more costly plant and consolidations into fewer and larger systems.









Western States Increase Productive Operations by 2 Per Cent During 1927

THE year 1928 opened with the manufacturing plants of the Western States operating on a plane about 8.2 per cent over that at the opening of 1927. This rate of annual increase in production in this section is about the rate of annual growth which has been witnessed during the past three years, which in turn is an indication that in general the manufacturing plants of the West have not been subject to the same influences which have affected general industry in the nation as a whole.

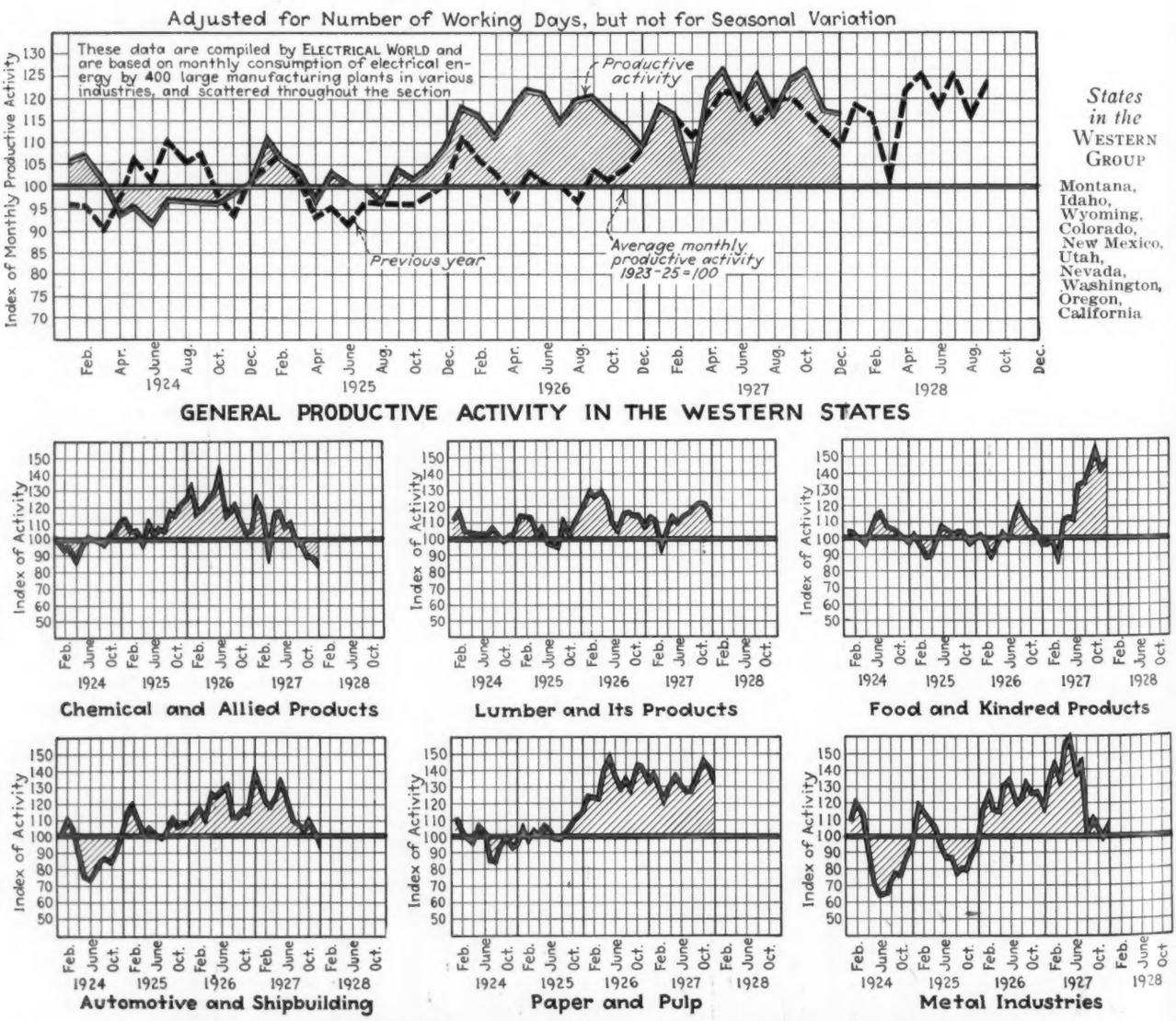
Operations of manufacturing plants in this section during 1927 as a whole were 2 per cent over those reported during 1926, which was materially under the annual industrial gain recorded in this section during 1926. The year just closed, however, witnessed general industrial operations above those of the same months in 1926, with the exception of February, March, June and August. There is every reason to believe that 1928 industrial production in the Western States will be over that of 1927.

Indexes of Productive Activity in the Western States

All Figures Adjusted for Number of Working Days

	Dec., 1927	Nov., 1927	Dec., 1926	Average for Full Year, 1927	Average for Full Year, 1926
All industries	116.9	117.0	108.0	118.8	116.5
Chemical and allied products	84.7	89.4	105.6	103.4	119.7
Food and kindred products	148.5	140.0	95.2	123.2	103.4
Lumber and its products	110.7	120.0	105.3	112.4	117.7
Metals industrial group	108.8	97.8	116.7	127.3	123.7
Paper and pulp	132.4	142.6	131.2	133.3	134.2
Rubber and its products	89.0	107.7	.....	.....	.....
Shipbuilding	95.8	102.1	141.0	114.6	120.8
Stone, clay and glass	142.0	159.0	.....	.....	.....

ELECTRICAL WORLD *Barometer of Industrial Activity in the Western States*


Adjusted for Number of Working Days, but not for Seasonal Variation
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 400 large manufacturing plants in various industries, and scattered throughout the section
Index of Monthly Productive Activity
Productive activity
Previous year
Average monthly productive activity 1923-25=100
States in the WESTERN GROUP
Montana, Idaho, Wyoming, Colorado, New Mexico, Utah, Nevada, Washington, Oregon, California
GENERAL PRODUCTIVE ACTIVITY IN THE WESTERN STATES
Index of Activity
Chemical and Allied Products
Lumber and Its Products
Food and Kindred Products
Automotive and Shipbuilding
Paper and Pulp
Metal Industries
PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE WESTERN STATES